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WAR MACHINE

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One Day in August 1940

Soviet Fighter Development

Armed Forces of the World: Italian Air Force

A fully illustrated guide to Allied Fighters of World War II

WAR MACHINE

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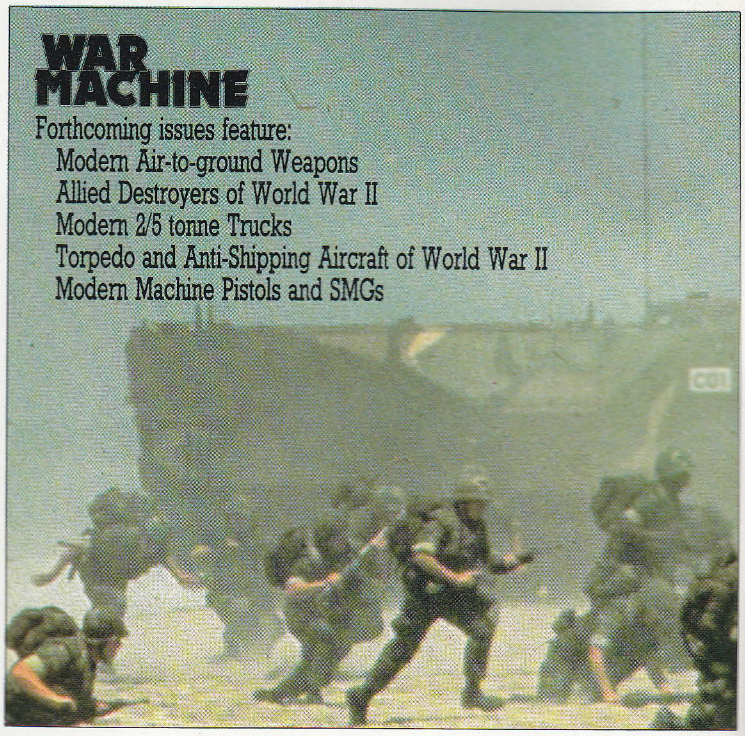

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Allied Fighters of World War II

World War II saw a stunning evolution in the capability of the single-seat fighter aircraft. Few people observing the light, short-ranged aircraft of the first year of the war would have predicted the multitude of tasks to come its way in such a short time.

Rolling out above the English countryside, a Spitfire Mk XII prepares for a sweep over occupied France. By late 1943 an invasion of Europe was being planned in detail, and RAF fighters were soon to operate from the fields of Normandy.

When devastating war once more burst on Europe in September 1939 the state of preparedness of the Allied air forces varied from the RAF's optimistic mediocrity to the downright ineptness of the French and Polish air forces, generally born of years of pacifism and parsimony. The monoplane fighter was in widespread use, albeit with little more than a couple of years' service behind it in most cases. Biplanes still served, if only to fill gaps yet to be occupied by more modern aircraft.

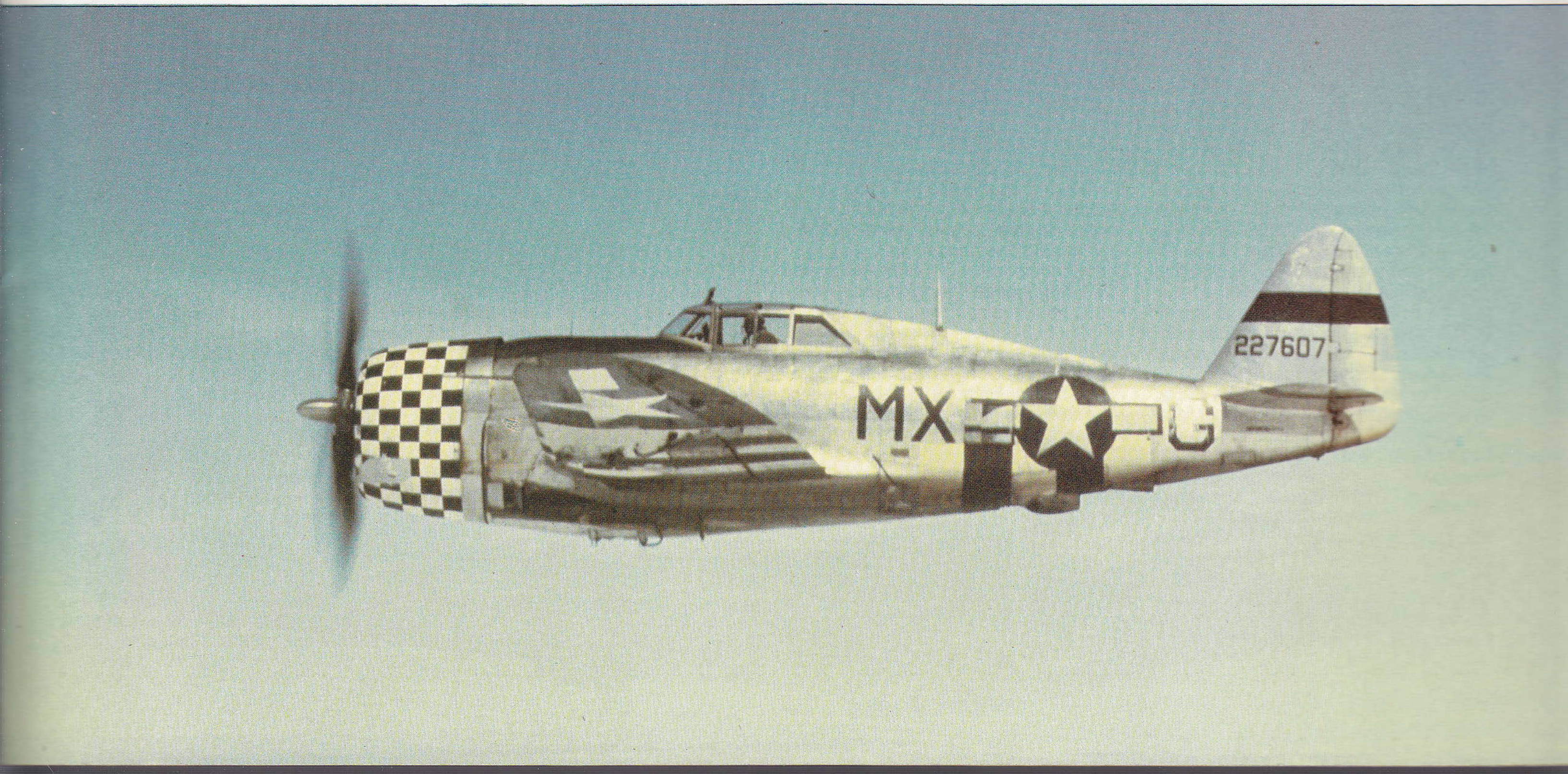
The finest Allied fighter in service in 1939, the immortal Supermarine Spitfire, served on only a handful of squadrons, was not regarded as fully operational, and demanded special servicing facilities at three or four nominated fighter bases. Yet within a year this aeroplane came to epitomize everything that was best in the RAF's fight against the Luftwaffe, and served in ever-improving versions long beyond the end of the war. Indeed it left its early partner, the Hawker Hurricane, far behind in the race to forge a weapon capable of matching Germany's great duo of fighters, the Messerschmitt Bf 109 and Focke-Wulf Fw 190. By 1941 RAF Fighter Command had adopted the Spitfire Mk VB, with its two 20-mm cannon and four rifle-calibre machine-guns, as its standard equipment.

It was the shock introduction in 1941 by the Luftwaffe of the superb Fw 190, however, that fired the starting gun for the technological race to accelerate fighter development. In the RAF the Spitfire Mk IX was rushed into service, as was the Hawker Typhoon, the latter still with many engine and airframe problems yet unresolved. American entry into the war at the end of 1941 did little to improve the fighter scene, neither the Bell P-39, Curtiss P-40 nor Republic P-43 being regarded as any match for the German fighters. In due course, however, the marriage of the superlative Rolls-Royce Merlin to the North American P-51 Mustang produced the war's finest long-range single-seat fighter, entering service in late 1943.

On the Eastern Front Germany's attack on the Soviet Union was accompanied by almost total destruction of the outdated indigenous equipment of the Red Air Force in 1941, a disastrous situation that was to some extent alleviated by the supply of Western aircraft to bolster Soviet resistance in the air. In an amazingly short time, however, having moved the aircraft industry far to the East, the Soviets managed to introduce a number of promising new fighters, the Yakovlev Yak-3 and Lavochkin La-5 among them.

The last two years of the war found the Allies almost entirely re-equipped with fighters whose development had been undertaken wholly during the war, thereby drawing on combat experience. The Hawker Tempest joined the Typhoon (which nevertheless proved an excellent ground-attack weapon), while Griffon-powered Spitfires formed a large proportion of Fighter Command's air combat force. The USAAF was almost entirely equipped with the classic Lockheed P-38, P-47 and P-51 trio as well as late-series P-40s. In the Red Air Force the Lavochkin La-7 and Yakovlev Yak-9 were proving more than a match for the majority of Luftwaffe fighters, flown as they were by hastily-trained young pilots, while in the Pacific the American and British fighters all but annihilated the air forces of Japan. In the field of jet fighters, where in airframes Germany unquestionably led the Allies, only the RAF managed to introduce very small numbers of early Gloster Meteors.

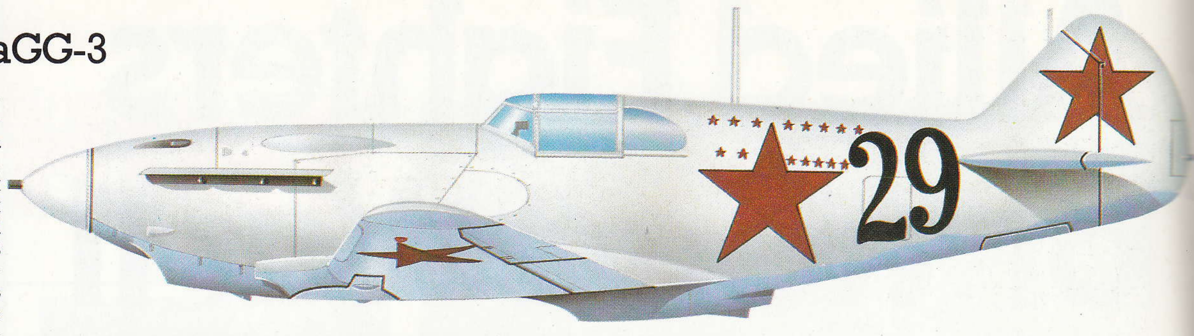
On its introduction the largest fighter ever to equip the USAAF, the Republic P-47 gave sterling service. More than 12,000 'D' models of this big, beefy fighter were built, at first in the 'razorback' form shown here but later with a bubble canopy.



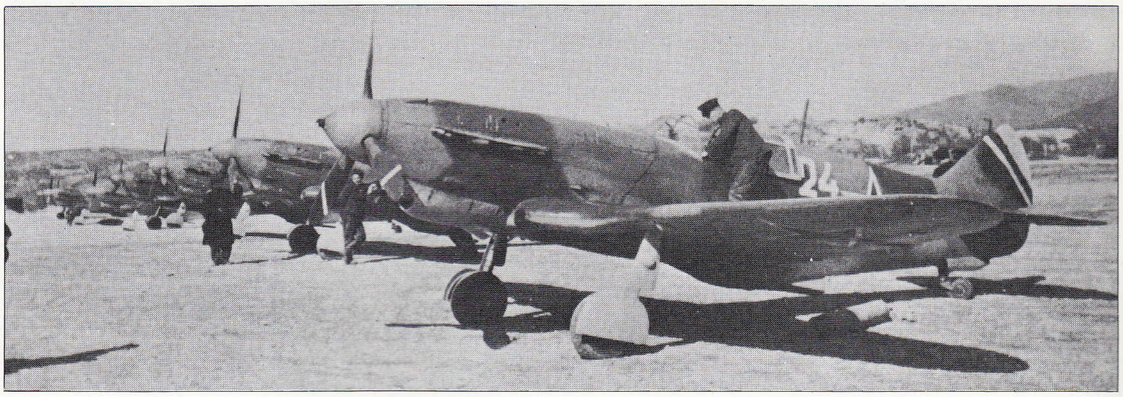
USSR

Lavochkin LaGG-3

Designed by a bureau headed by Semyon Lavochkin and including V. Gorbunov and M. Gudkov, the **Lavochkin LaGG-3** stemmed from the **LaGG-1**, whose prototype (the **I-22**) was first flown on 30 March 1940. These aircraft were unusual in retaining an all-wood structure; only the control surfaces (and later the landing flaps) were metal. This excellent little fighter was ordered into production in 1940 as the LaGG-1 with a 783-kW (1,050-hp) Klimov M-105 V-12 engine, but was too late to see service during the Winter War with Finland in 1939-40. With a top speed of 605 km/h (376 mph) and an armament of one 20-mm and two 12.7-mm (0.5-in) guns, the LaGG-1 was certainly one of the world's best fighters early in 1941, but pilots complained of poor climb performance and heavy controls, and a new version, the LaGG-3, was introduced by way of the **I-301** prototype after several hundred LaGG-1s had been delivered. At the time of the German attack two air regiments still flew the older aircraft, but within a year four regiments had received the LaGG-3, their task being to provide escort for the Ilyushin Il-2 close-support aircraft; they carried a variety of armament combinations, including wing attachments for six 8.2-cm (3.23-in) rockets or light bombs. The LaGG-3 featured a constant-speed propeller and improved rudder balancing, and was popular in service; it proved very robust and was capable of sustaining considerable battle damage. A better fighter was urgently needed, and the three designers each built new versions with the M-82 radial. In 1942 the liquid-cooled LaGG went out of production after about 6,528 had been built.



This LaGG-3 was flown by Captain G.A. Grigoryev in the winter of 1942/3, on the 6th Fighter Aviation Sector of the Central Front.



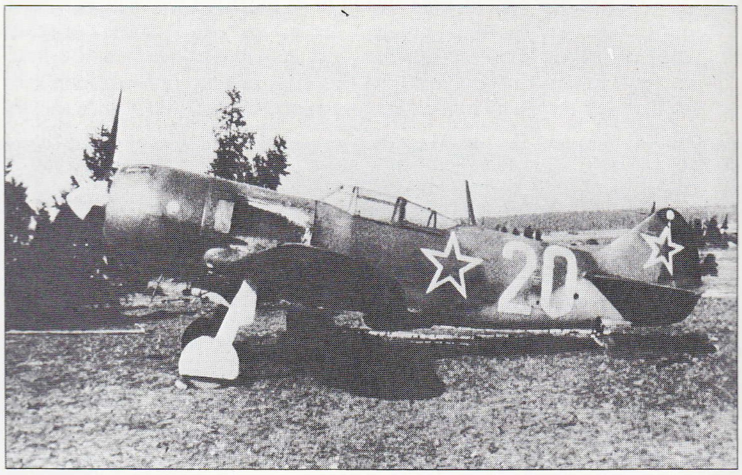
LaGG-3s of the 9th IAP (Fighter Aviation Regiment) serving on the Black Sea. The LaGG did not fare well at the hands of the Luftwaffe, although this was more a reflection of respective pilot training than of any failure of the aircraft.

Specification
Lavochkin LaGG-3
Type: single-seat fighter
Powerplant: one 925-kW (1,240-hp) M-105PF V-12 piston engine
Performance: maximum speed 575 km/h (357 mph) at 5000 m (16,405 ft); initial climb rate 900 m (2,950 ft) per minute; service ceiling 9700 m (31,825 ft); range 650 km (404 miles)
Weights: empty 2620 kg (5,776 lb); maximum take-off 3300 kg (7,275 lb)
Dimensions: span 9.80 m (32 ft 1.75 in); length 8.81 m (28 ft 11 in); height 2.70 m (8 ft 10 in); wing area 17.51 m^2 (188.5 sq ft)
Armament: one 20-mm ShVAK hub-firing cannon and two 12.7-mm (0.5-in) UBS machine-guns or two 7.62-mm (0.3-in) ShKAS machine-guns, plus provision for six underwing 8.2-cm (3.23-in) rockets or four 50-kg (110-lb) bombs

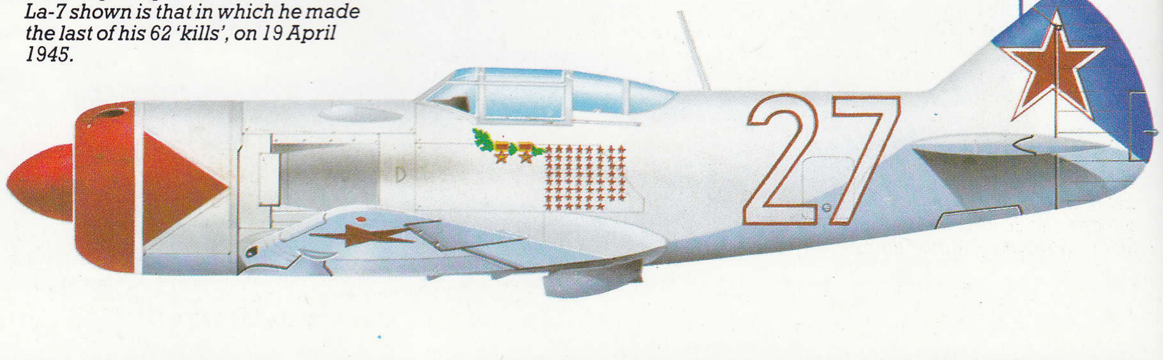
USSR

Lavochkin La-5 and La-7

As the Soviet armies reeled back after the initial assault by Germany in the East during 1941, frantic demands were made for modern equipment to be supplied to the Soviet air force. In October 1941 Semyon Lavochkin started work on the **Lavochkin LaG-5** fighter with 1194-kW (1,600-hp) M-82 radial, passing on almost immediately to a development, the **La-5**, with cut-down rear fuselage which gave improved visibility for the pilot. The prototype completed its acceptance trials in May 1942 and entered production two months later; by the end of the year no fewer than 1,182 examples had been completed. In March 1943 the next and principal version, the **La-5FN**, entered production, a total of 21,975 aircraft including the later **La-7** being produced before the end of the war; the La-5FN featured the 1231-kW (1,650-hp) ASh-82FN engine, but its two 20-mm cannon were supplemented by four 8.2-cm (3.23-in) RS 82 rocket projectiles or two PTAB anti-tank weapons. A two-seat trainer version, the **La-5UTI**, was also produced. Later aircraft were armed with two 23-mm guns in place of the 20-mm weapons. In 1944 the La-7 appeared with an armament of three 20- or 23-mm cannon, an uprated ASh-82FN engine and a top speed of 680 km/h (423 mph). The first large-scale use of the La-5 was during the fighting around Stalingrad in November 1942; it was essentially a low/medium-altitude fighter, and during the great armour battles at Kursk in July 1943 La-5s were employed in a tank-busting role, and after having discharged their hollow-charge missiles against ground targets they would climb to give fighter cover to the slower Ilyushin Il-2 support aircraft. The highest-scoring of all Allied fighter pilots of the war, Ivan Kozhedub, achieved all his 62 combat victories while flying La-5s, La-5FNs and La-7s between 26 March 1943 and 19 April 1945.

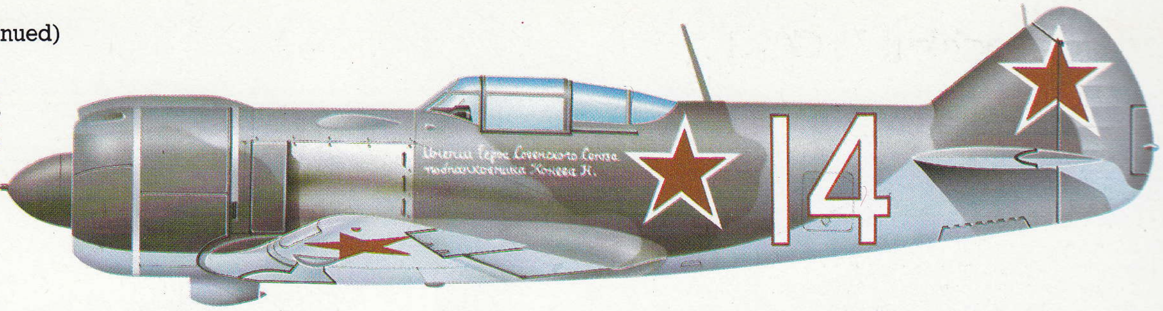


A refinement of the La-5, itself a development of the LaGG-3, the La-7 was to be the last of Lavochkin's mixed wood and metal construction fighters. By the time of its introduction to the battle in spring 1944, the Germans were in retreat all along the Eastern Front.



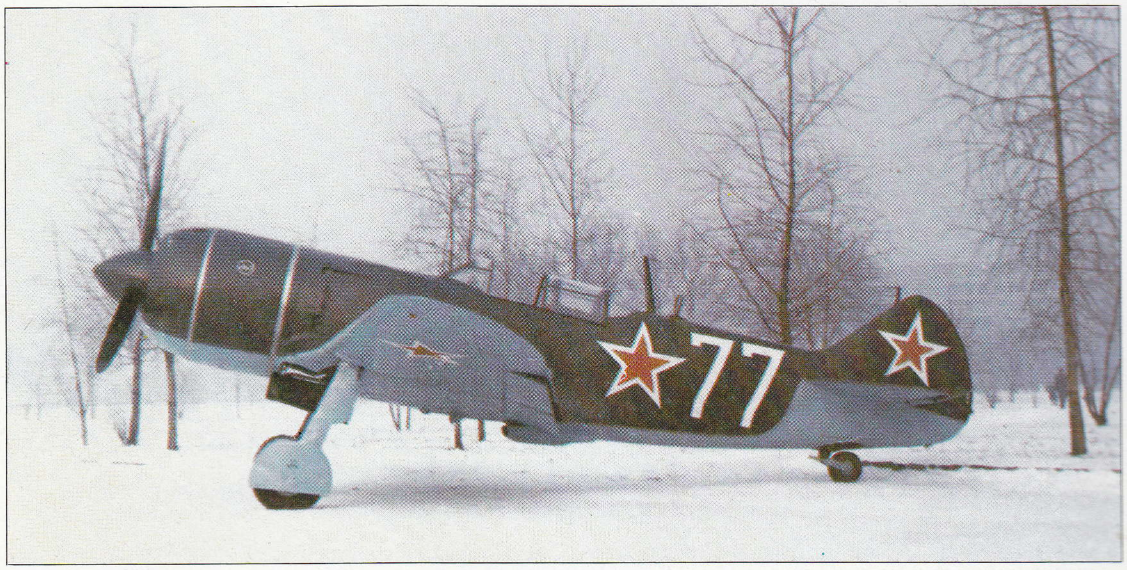
Ivan Kozhedub was the top-scoring Allied fighter pilot of the war. The La-7 shown is that in which he made the last of his 62 'kills', on 19 April 1945.

Lavochkin La-5 and La-7 (continued)



Kozhedub flew this La-5FN in the summer of 1944. The aircraft had been presented to the unit by the father of Hero of the Soviet Union Lieutenant-Colonel Konyev in memory of his son.

Specification
Lavochkin La-5FN
Type: single-seat fighter/fighter-bomber
Powerplant: one 1231-kW (1,650-hp) ASh-82FN radial piston engine
Performance: maximum speed 647 km/h (402 mph) at 5000 m (16,405 ft); climb to 5000 m (16,405 ft) in 5.0 minutes; service ceiling 11000 m (36,090 ft); range 765 km (475 miles)
Weights: empty 2605 kg (5,743 lb); normal take-off 3360 kg (7,408 lb)
Dimensions: span 9.80 m (32 ft 1.75 in); length 8.67 m (28 ft 5.3 in); height 2.54 m (8 ft 4 in); wing area 17.59 m^2 (189.3 sq ft)
Armament: two nose-mounted 20-mm ShVAK cannon (on later aircraft 23-mm NS cannon), plus provision for four 8.2-cm (3.23-in) RS-82 rockets or 150 kg (331 lb) of bombs

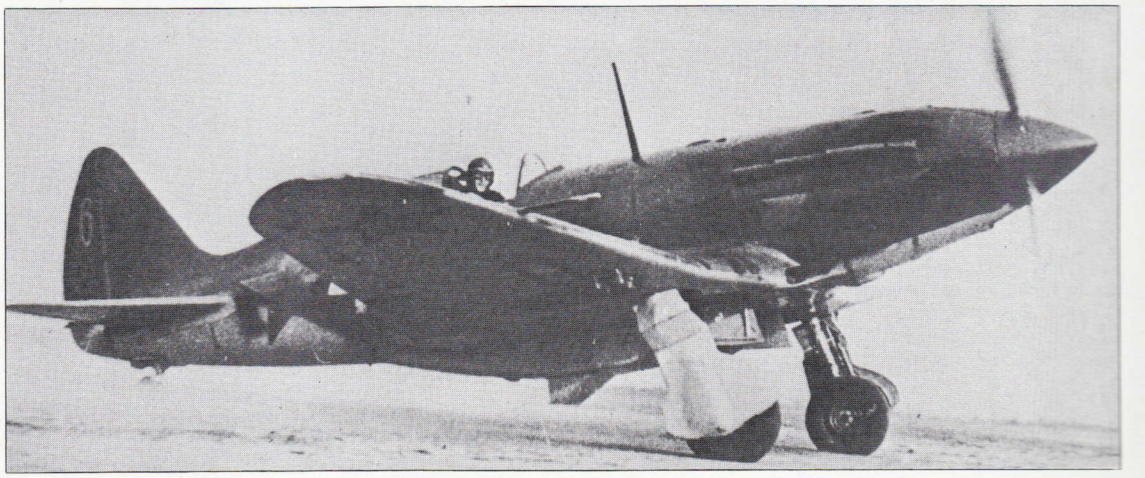


Semyon Lavochin's La-7 featured an uprated engine, giving it a top speed of 680 km/h (423 mph) and many minor improvements which made this aircraft one of the most effective of the war. Those made at the Moscow factory carried two cannon, whilst those built at Yaroslavl had three.

USSR

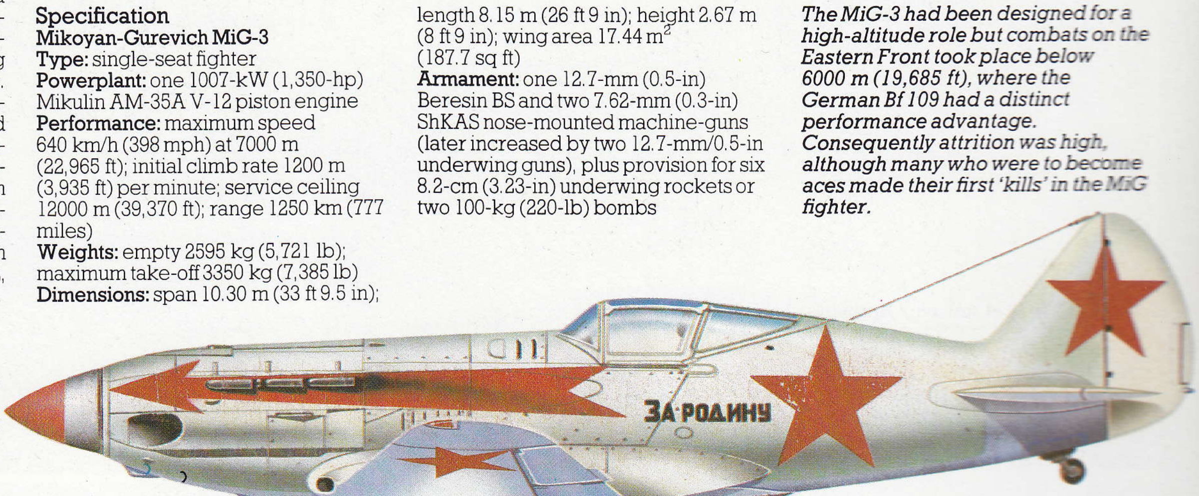
Mikoyan-Gurevich MiG-3

Gaining a reputation as a 'hot ship' in the early years, the **Mikoyan-Gurevich MiG-3** was plagued by difficult handling and very poor armament, and although among the fastest of Soviet fighters of that period, it proved no match for the German Bf 109G or Fw 190. Flown in prototype form as the **I-61** in the spring of 1940, the initial design included the 895-kW (1,200-hp) Mikulin AM-35 V-12 engine, and this was retained in the production **MiG-1**, which started appearing in September 1940. Handicapped by the overall length of the engine, which resulted in poor pitch and directional stability, and armed with only three machine-guns, the MiG-1 suffered heavily in the opening months of Operation 'Barbarossa', and the MiG-3, delivered during the second half of 1941, proved little better with a 1007-kW (1,350-hp) AM-35A engine, which gave the fighter a top speed of 640 km/h (398 mph); introduced at the same time was a constant-speed propeller, increased wing dihedral and sliding cockpit canopy. Handling was only marginally improved, so the MiG-3 was transferred to attack bomber escort and close support duties; in 1942 two 12.7-mm (0.5-in) machine guns were added in underwing fairings by operational units, but gradually the aircraft was replaced by radial-engine fighters such as the La-5. Total production was 3,422, of which 100 were the earlier MiG-1.



Specification
Mikoyan-Gurevich MiG-3
Type: single-seat fighter
Powerplant: one 1007-kW (1,350-hp) Mikulin AM-35A V-12 piston engine
Performance: maximum speed 640 km/h (398 mph) at 7000 m (22,965 ft); initial climb rate 1200 m (3,935 ft) per minute; service ceiling 12000 m (39,370 ft); range 1250 km (777 miles)
Weights: empty 2595 kg (5,721 lb); maximum take-off 3350 kg (7,385 lb)
Dimensions: span 10.30 m (33 ft 9.5 in); length 8.15 m (26 ft 9 in); height 2.67 m (8 ft 9 in); wing area 17.44 m^2 (187.7 sq ft)
Armament: one 12.7-mm (0.5-in) Beresin BS and two 7.62-mm (0.3-in) ShKAS nose-mounted machine-guns (later increased by two 12.7-mm/0.5-in underwing guns), plus provision for six 8.2-cm (3.23-in) underwing rockets or two 100-kg (220-lb) bombs

The MiG-3 had been designed for a high-altitude role but combats on the Eastern Front took place below 6000 m (19,685 ft), where the German Bf 109 had a distinct performance advantage. Consequently attrition was high, although many who were to become aces made their first 'kills' in the MiG fighter.



A MiG-3 of the 34 IAP operating from Vnukovko in the defence of Moscow in the winter of 1941/2. The aircraft is adorned with that most potent of Soviet slogans, 'For the Fatherland!'

Soviet Fighter Development

Launched into a war for which they were disastrously unprepared, the Soviet Union suffered grievous losses during the triumphant German offensive. Nowhere was the qualitative gulf between the respective weaponry more apparent than in the air forces, yet within two years the Soviets were on equal terms.

To a great extent politically, socially and technologically isolated from the Western world during the vicious pre-war Stalinist dictatorship, the Soviet arms manufacturing industry had, before the outbreak of World War II, struggled at considerable disadvantage to maintain some degree of technical parity with other nations. Yet in the field of aircraft design the Soviet aircraft industry had managed to conceive a number of good aircraft in pre-war years, such as the Tupolev SB-2 bomber and the Polikarpov I-16 monoplane fighter. Development had been laboured, but both these aircraft in particular had shown considerable promise when committed to combat in the skies over revolutionary Spain immediately before the world war.

Soviet fighter design at the beginning of the war was in truth hamstrung by the lack of a powerful, compact and reliable engine of indigenous design, neither the German nor British engine manufacturers being willing to divulge details of their latest liquid-cooled powerplants, the Daimler-Benz DB601 and Rolls-Royce Merlin; indeed, the technical sophistication and cost of such engines were probably beyond the manufacturing resources of the Soviet industry at that time. Instead the Soviets had to be content with development of such powerplants as the Hispano-Suiza 12Y (likewise a drawback to the French).

At the beginning of the war in Europe, therefore, the Soviet air force still possessed no fighter better than the I-16, and the yet older Polikarpov I-15 biplane, and these two were deployed against the Finns (with only limited success) during the Winter War of 1939-40. There were nevertheless stars in the ascendancy among Soviet aircraft designers, among them Aleksandr S. Yakovlev, Artem I. Mikoyan and Mikhail I. Gurevich, the last two combining in a design bureau (thereby forming the famous 'MiG' partnership) to produce the MiG-1 fighter, whose prototype first flew in the spring of 1940. As with most Soviet aircraft of the early war period, considerable use was made of wooden construction in this fighter, but its principal weakness lay in the long, heavy Mikulin AM-35 V-12 engine, which demanded very careful use of the throttle during take-off and landing because of inadequate lateral control; gun armament was poor (one 12.7-mm/0.5-in and two 7.62-mm/0.3-in synchronized machine-guns), and it was not long (early 1942) before this tricky aeroplane was relegated to ground attack duties.

Yakovlev's first fighter essay fared much better despite its dependence on the less powerful M-105 (Hispano-Suiza 12-development) engine. The I-26 prototype of the Yak-1 had flown in 1940 and production examples (with a performance roughly the same as that of the Spitfire Mk I) were being delivered to the V-VS before the end of 1940. Capable of holding its own with the German Bf 109E (but not the Bf 109F), the Yak-1 was selected for mass production and, despite movement of its manufacturing plant hundreds of miles to the east when Germany invaded the Soviet Union in 1941, deliveries were little affected, and by the end of the year some 500 aircraft were in service.

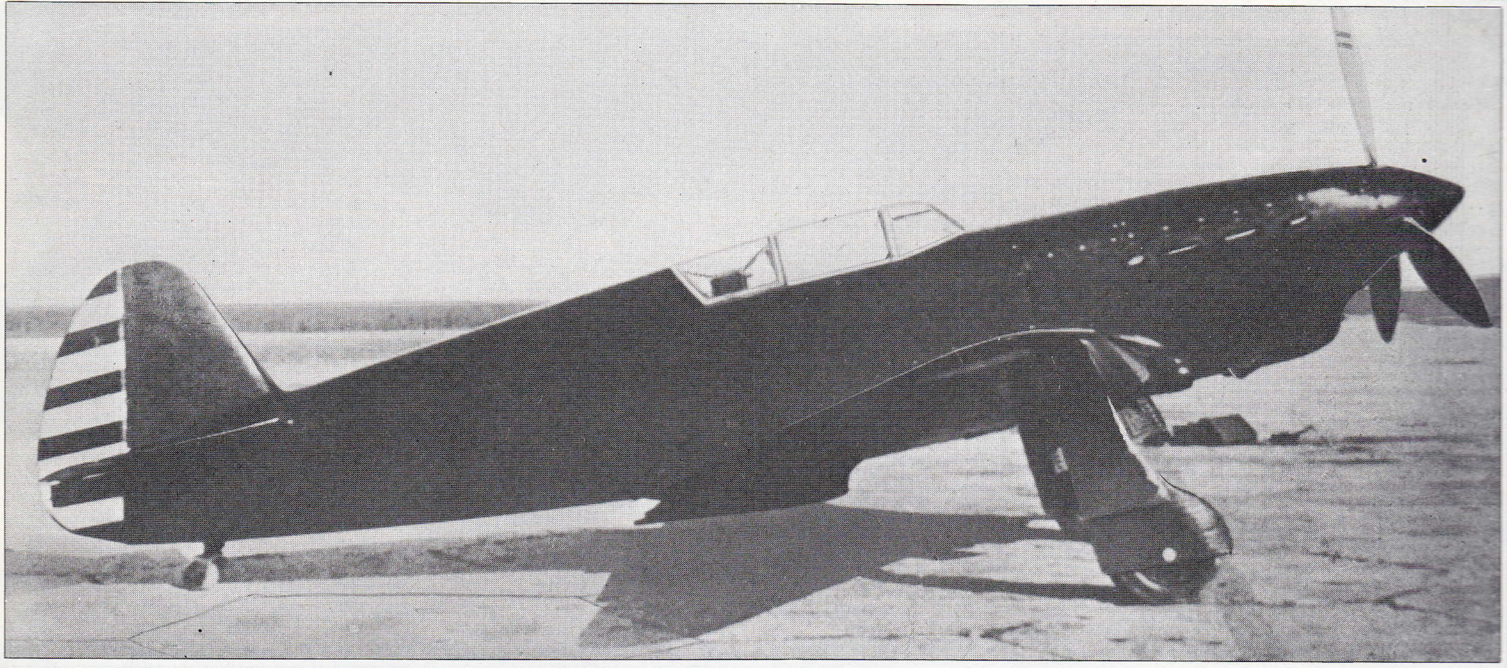
Short of sophisticated aluminium alloys, Soviet designers made as much use of wood as possible, with a large proportion of aircraft such as the LaGG-3 made of the material. Though the structures were refined and complex they were tough and easily repaired, ideal for conditions at the front.

A third Soviet fighter also started delivery to the V-VS in 1940, namely Semyon A. Lavochkin's LaGG-1, also powered by an M-105 and built almost entirely of wood. Handling qualities were inferior to those of the Yak-1 and production soon switched to the LaGG-3 with constant-speed propeller, leading-edge slats and improved armament provision.

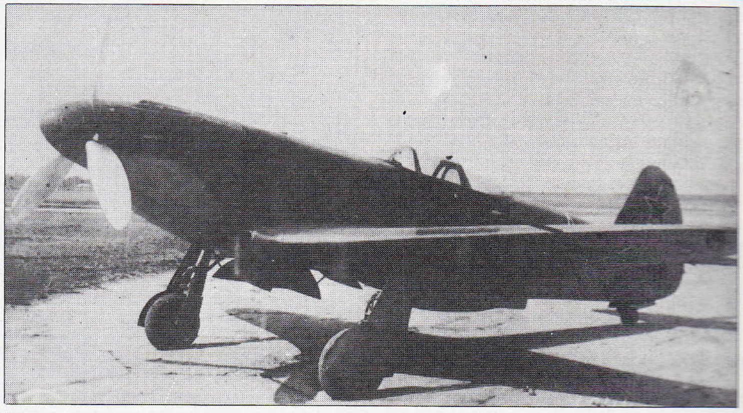
This trio of fighters, namely the MiG-1, Yak-1 and LaGG-3, thus increasingly provided the strength of the Soviet fighter arm during the first year of desperate fighting on the Eastern Front. They also formed the basis of almost all future wartime fighter development. Flown by experienced pilots, they were just capable of matching the older Luftwaffe fighters in the air. However, experienced Soviet pilots were a relative scarcity, having suffered calamitous casualties in the disastrous first weeks of Operation 'Barbarossa', and the steadily growing numbers of Bf 109Fs and Bf 109Gs proved too much for the hastily-trained Soviet pilots.

As the German steamroller advance was slowed on the ground during the latter half of 1942 the Soviet aircraft industry was frantically developing new versions of the original fighter trio. Combat experience had shown the vulnerability of wooden construction and efforts were made to increase the proportion of metal primary structures in most Soviet aircraft, and at the same time improved, larger and faster-firing guns were introduced, although Soviet designers tended to cling to the age-old nose-mounted, synchronized gun armament. The Yak-1 gave place to the Yak-7 and Yak-9 series and also the Yak-3 which, despite having to stick with the VK-105PF engine, returned a speed of about 660 km/h (410 mph). The Hispano-based engine was still favoured as this allowed the installation of a hub-firing 20-mm ShVAK cannon, although nose-mounted 12.7-mm (0.5-in) guns were also retained. Earlier the Yak-9 had been introduced, some of which carried 37- or 45-mm hub cannon, and this outfought the Bf 109G when first flown in action over Stalingrad at the end of 1942. Indeed production

Final developments in the piston-engined Lavochkin story saw outstanding, all-metal aircraft such as the La-9 entering service. While bearing superficial resemblance to its La-5 and La-7 progenitors, it was to all intents a new design.



The I-26 second prototype of the great series of piston-engined Yak fighters seen in 1940. Yakovlev was a noted designer of light sporting aircraft, and his simple fighter, largely made of wood and welded tube, was an elegant and effective design with a good performance and great potential.



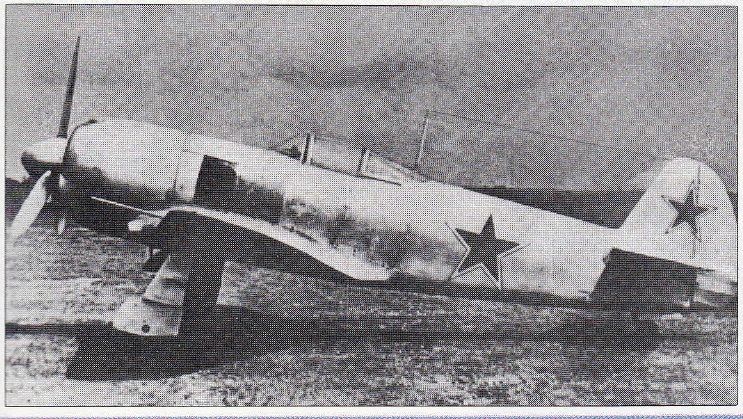
The Yak-1 family soon split into light and heavy types, with the Yak-3 being the smallest and lightest of them. At low altitudes, the Yak-3 soon proved markedly superior to the Bf 109G and the Fw 190A in service with the Luftwaffe, but it did not arrive in numbers until late 1944.

of Yakovlev's family of fighters far outstripped anything achieved in the West during the war, more than 37,000 such aircraft being produced in 50 months.

Development of the MiG fighter family was less successful, the MiG-1 being replaced in production by the MiG-3 with more powerful AM-35A, constant-speed propeller, sliding cockpit canopy and increased wing dihedral. Although less of a 'hot ship' than the MiG-1, the MiG-3 was still unpopular and was quickly relegated to close-support work. The radial-engine I-211 development was said to be a considerable improvement but, following the success being achieved by the La-7 and Yak-9, did not attract large production orders.

By contrast the disappointing LaGG-3 came to be developed into the successful La-5, La-5FN and La-7 family. In much the same way that German (and later, British) fighter designers succeeded in marrying air-cooled radial engines to fighter airframes, Lavochkin selected the 1,700-hp (1268-kW) Shvetsov M-82 radial and produced an excellent fighter, the La-5FN, capable of matching most German single-seaters below about 4500 m (14,765 ft), but less suitable at higher altitudes. The aircraft was therefore largely developed as a specialist close-support fighter, the La-7 often being armed with underwing rockets. These fighters were tremendously popular among Soviet pilots and, although having slightly lower speed than the Yak-3 and Yak-9, were exploited to the full by many of the top-scoring fighter aces of the V-VS, of whom Ivan Kozhedub was the highest with a score of 62 victories (including a single Messerschmitt Me 262 jet), all of them gained on Lavochkins.

While Yakovlev and Lavochkin fighters constituted the vast majority of Soviet fighter production in the last two years of the war, the MiG bureau turned its attention to the problems of high-altitude fighters, but little or no realistic progress was made in the development of a Soviet jet engine until examples of German turbojets fell into Soviet hands early in 1945. By then it was too late to consider diverting manpower to this new field before the end of the war.



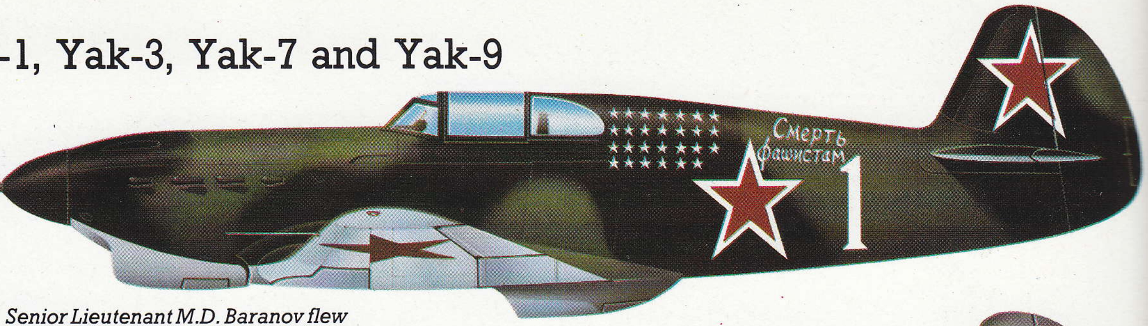
Left: Yakovlev produced over 37,000 fighters with the Klimov VK-105 and VK-107 engines, whose main advantage was that they allowed the carriage of a large-calibre hub-mounted cannon. This Yak-7 was tested with a Shvetsov ASh-82FNV radial engine, which was not adopted.

Above: The heavy branch of the Yak fighter family is exemplified by the Yak-9, an early squadron of which is seen here. By the end of the war, more than 16,750 Yak-9s had been produced, making it and its varients the most important aircraft in the V-VS, apart from the Il-2.

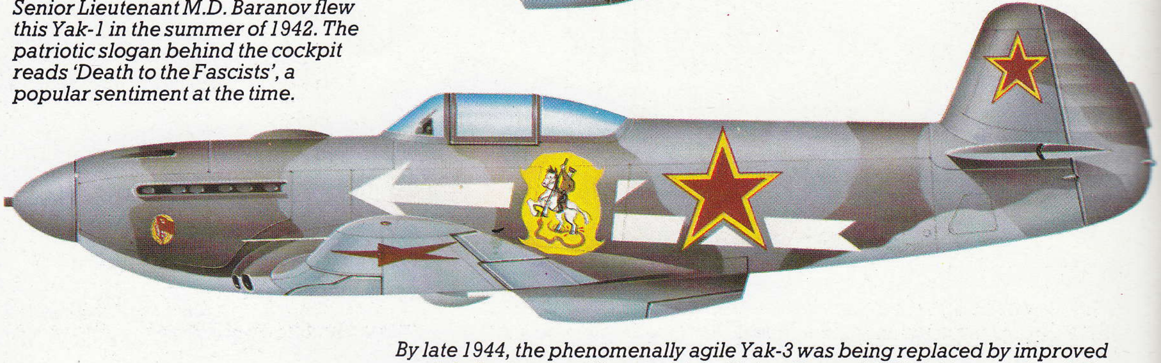
USSR

Yakovlev Yak-1, Yak-3, Yak-7 and Yak-9

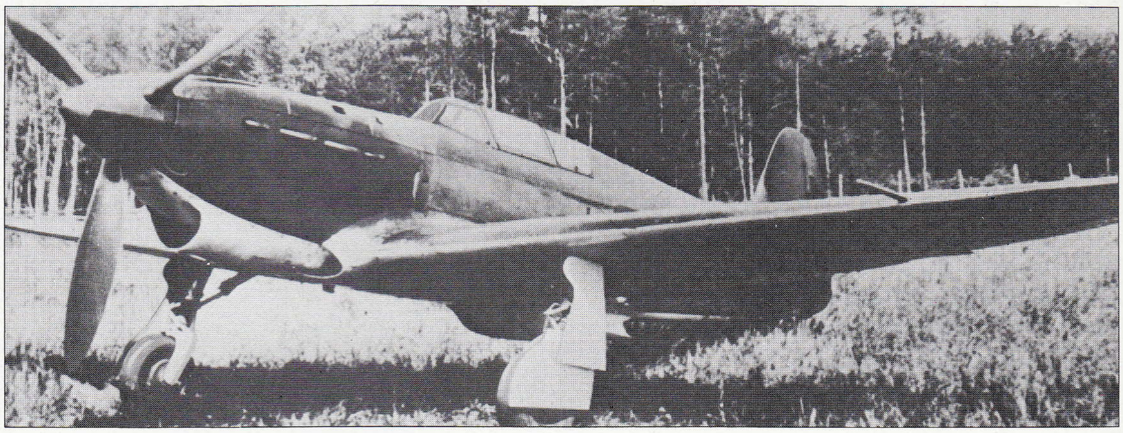
It is said that 37,000 Yakovlev fighters were produced during World War II, of which the vast majority were of the **Yakovlev Yak-9** that could outfight the German Bf 109G as early as the time of the Stalingrad campaign. Developed progressively from the **Yak-1** (which first flew in January 1940), through the **Yak-7B** which served from early 1942, the Yak-9 was first flown in its production form in the summer of that year, returning a speed of 600 km/h (373 mph). Numerous versions of this versatile fighter were developed, including the **Yak-9T** anti-tank fighter with 940-kW (1,260-hp) Klimov VK-105PF V-12 engine and 37-mm hub-firing cannon, the **Yak-9B** fighter-bomber with provision for 400 kg (882 lb) of bombs, the **Yak-9D** long-range fighter and the **Yak-9DD** very long-range escort fighter, the latter being flown as escort for USAAF bombers on shuttle raids between the UK and the Soviet Union late in the war. The **Yak-9U** fighter, with 1231-kW (1,650-hp) VK-107A engine and a top speed of 700 km/h (435 mph), was the final version to see combat during the war and represented the point at which Soviet technology may be said to have finally caught up with that of the West, and came to be much respected by the best Luftwaffe pilots in their final generation of Bf 109K and Fw 190D fighters. The **Yak-3** was perhaps the war's most manoeuvrable monoplane fighter, and entered service in 1944 as a lightened derivative of the Yak-1 series.



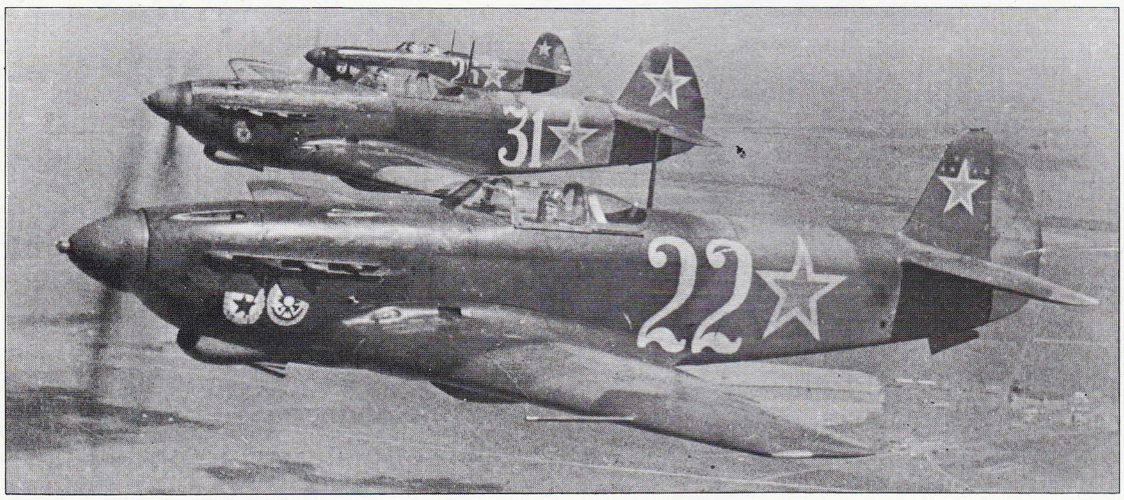
Senior Lieutenant M.D. Baranov flew this Yak-1 in the summer of 1942. The patriotic slogan behind the cockpit reads 'Death to the Fascists', a popular sentiment at the time.



By late 1944, the phenomenally agile Yak-3 was being replaced by improved models, but senior officers such as Major-General G.N. Zakharov of the 303 Fighter Aviation Division often kept them as personal mounts.



Right: The early production Yak-1 came to the front in large numbers in the early days of Barbarossa, and was disliked by some pilots who were used to the less advanced aerodynamics of the Polikarpov biplanes which had equipped many Soviet aviation regiments.



Above: Yak-9Ds of a Guards regiment operating in the Crimea. The nearest aircraft is the mount of Colonel Avdyeyev and bears the Order of the Red Banner. By the summer of 1944, when the photo was taken over Sevastopol, Soviet fighters were often superior.

Specification

Yakovlev Yak-9U

Type: single-seat fighter

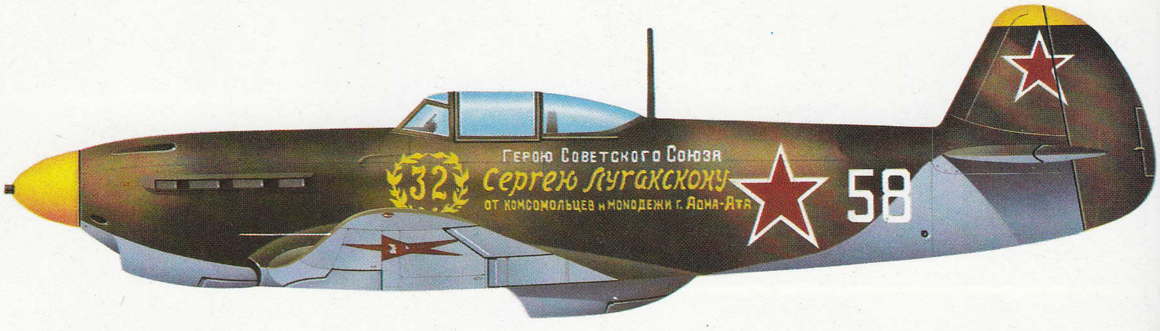
Powerplant: one 1231-kW (1,650-hp) VK-107A V-12 piston engine

Performance: maximum speed 700 km/h (435 mph) at 5000 m (16,405 ft); climb to 5000 m (16,405 ft) in 3.8 minutes; service ceiling 11900 m (39,040 ft); range 870 km (540 miles)

Weights: empty 2575 kg (5,677 lb); normal take-off 3098 kg (6,830 ft)

Dimensions: span 9.77 m (32 ft 0.6 in); length 8.55 m (28 ft 0.6 in); height 2.44 m (8 ft 0 in); wing area 17.25 m^2 (185.7 sq ft)

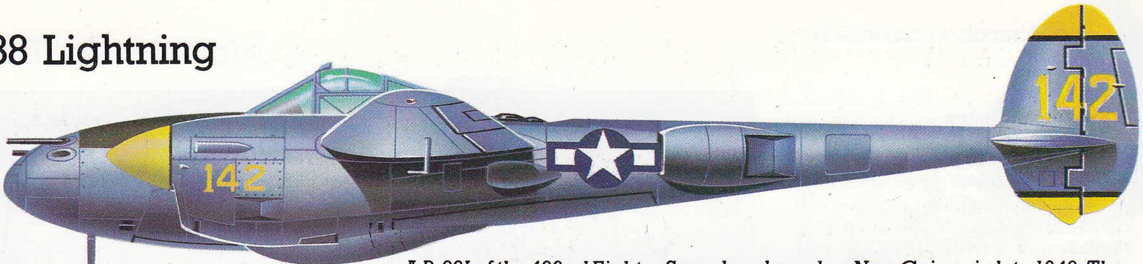
Armament: one 23-mm hub-firing VYa-23V cannon and two 12.7-mm (0.5-in) UBS machine-guns, plus provision for two 100-kg (220-lb) bombs



Right: This Yak-1M was presented by the young Communists of Alma Alta and was flown by Sergei Lugansky, victor at the time over 32 enemies.

USA

Lockheed P-38 Lightning



A P-38J of the 432nd Fighter Squadron based on New Guinea in late 1943. The 'J' models were the first to have relocated radiators and leading-edge tankage.

Representing Lockheed's first fighter aircraft project, the twin-engine, twin-boom **Lockheed P-38 Lightning** was designed to meet a 1937 requirement for a high-altitude interceptor. First flown on 27 January 1939, the **XP-38** was followed by production **P-38**s with nose armament of one 37-mm and four 12.7-mm (0.5-in) guns and powered by Allison V-1710-27/29 engines; their top speed of 628 km/h (390 mph) was greater than any other twin-engine fighter in 1941. The first version to be considered fully operational was the **P-38D**, however, and this was reaching squadrons at the time of Pearl Harbor. The first of an order for 143 aircraft for the RAF arrived in the UK in December 1941, but after evaluation the Lightning was rejected (on account of a ban imposed on the export of turbochargers) and the contract cancelled. In the USAAF the P-38D was followed by the **P-38E**, in which the 37-mm cannon was replaced by a 20-mm weapon. The **P-38F**, with provision for up to a 907-kg (2,000-lb) bombload under the wings, was followed by the **P-38G** with minor equipment changes; the **P-38H** could carry up to 1452 kg (3,200 lb) of bombs. In the **P-38J** (of which 2,970 were produced) the radiators were located in deep 'chin' fairings immediately aft of the propellers; with maximum external fuel load this version had an endurance of about 12 hours, and it was in this model of the P-38 that America's top scoring fighter pilot of the war, Major Richard I. Bong, gained the majority of his 40 victories. The **P-38L** was the most-built version (a total of 3,923) and differed from the P-38J only in having -111/113 engines in place of the -89/91s previously used. Photo-reconnaissance conversions, the **F-4** and **F-5**, were also widely used in Europe and the Far East. Production of all Lightnings totalled 9,394.

Specification

Lockheed P-38L Lightning

Type: single-seat fighter/fighter-bomber

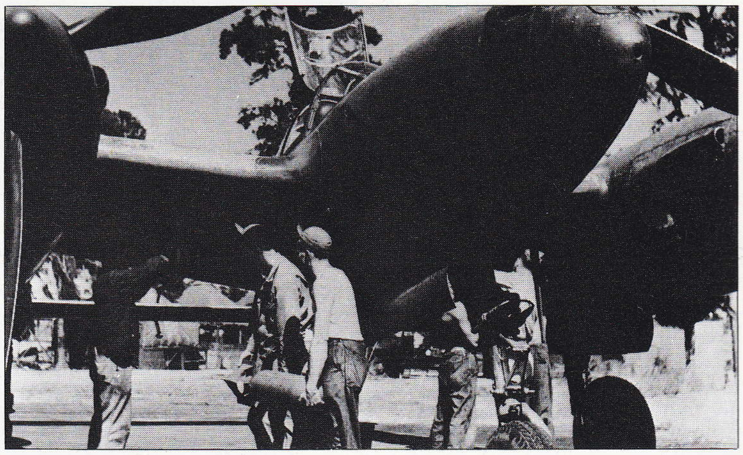
Powerplant: two 1100-kW (1,475-hp) Allison V-1710-111/113 V-12 piston engines

Performance: maximum speed 666 km/h (414 mph) at 7620 m (25,000 ft); climb to 6095 m (20,000 ft) in 7.0 minutes; service ceiling 13410 m (44,000 ft); range 724 km (450 miles)

Weights: empty 5806 kg (12,800 lb); maximum take-off 9798 kg (21,600 lb)

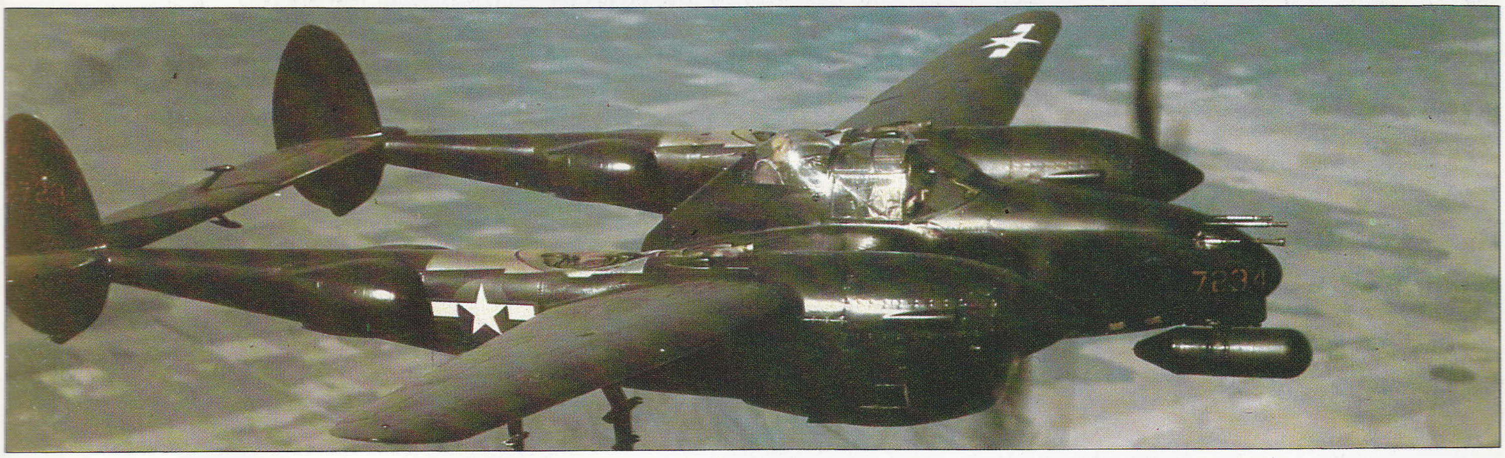
Dimensions: span 15.85 m (52 ft 0 in); length 11.52 m (37 ft 10 in); height 2.99 m (9 ft 10 in); wing area 30.42 m^2 (327.5 sq ft)

Armament: one 20-mm and four 12.7-mm (0.5-in) guns in the nose, plus a bombload of up to two 726-kg (1,600-lb) bombs under the wings



Above: At the AAF Tactical Center in Orlando, Florida, technicians load a P-38 with bombs before a skip bombing run. With the retention of the full fighter nose armament of 20-mm and 12.7-mm guns, the P-38 could provide its own flak suppression at low level.

Below: The big Lockheed fighter saw service in a number of variants, the P-38M being a night fighter. This two-seat, radar-equipped model was used operationally in the Pacific during the latter stages of the war. It retained the full weapon fit of the day fighter versions.

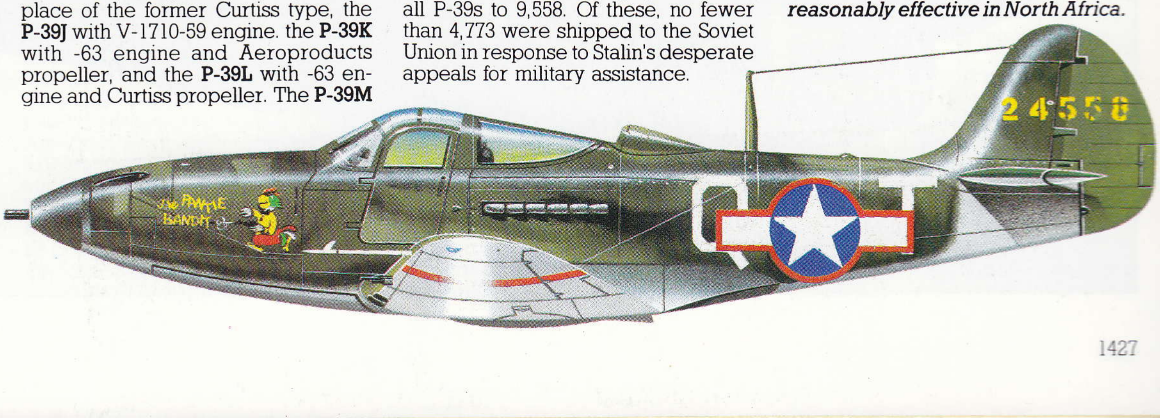


USA

Bell P-39 Airacobra

The radical **Bell P-39 Airacobra** single-seat fighter was designed around the hub-firing 37-mm T-9 cannon which had given impressive demonstrations in 1935. The Allison V-12 engine was located amidships behind the cockpit, driving the propeller by an extension shaft, and nosewheel landing gear was adopted. The prototype **XP-39** was first flown in April 1939; production **P-39D** aircraft entered service with the USAAC in 1941 and first saw combat in the Pacific theatre in April 1942. P-39Ds also served with US forces in Europe but suffered heavily in action; they also flew with one RAF squadron (No. 601) but persistent problems caused them to be withdrawn after scarcely a single action. The Airacobra flew with much better results with three USAAF groups based in North Africa from the end of 1942. The P-39D was followed by the **P-39F**, which introduced an Aeroproducts propeller in place of the former Curtiss type, the **P-39J** with V-1710-59 engine. the **P-39K** with -63 engine and Aeroproducts propeller, and the **P-39L** with -63 engine and Curtiss propeller. The **P-39M** introduced the -83 engine with large-diameter propeller. Final and most-built versions were the **P-39N** and **P-39Q** with -85 engine; production amounted to 2,095, bringing the total of all P-39s to 9,558. Of these, no fewer than 4,773 were shipped to the Soviet Union in response to Stalin's desperate appeals for military assistance.

A Bell P-39L Airacobra, operated by the 93rd FS, 81st FG in Tunisia in 1943. Successful in Soviet hands, the P-39 proved no match for the agile Zero in the Pacific, but was reasonably effective in North Africa.



Specification

Bell P-39N Airacobra

Type: single-seat fighter bomber
Powerplant: one 895-kW (1,200-hp) Allison V-1710-85 V-12 piston engine
Performance: maximum speed 642 km/h (399 mph) at 2955 m (9,700 ft); climb to 4570 m (15,000 ft) in 3.8 minutes; service ceiling 11735 m (38,500 ft); range 1207 km (750 miles)
Weights: empty 2566 kg (5,657 lb); maximum take-off 3720 kg (8,200 lb)
Dimensions: span 10.36 m (34 ft 0 in); length 9.19 m (30 ft 2 in); height 3.78 m (12 ft 5 in); wing area 19.79 m^2 (213.0 sq ft)
Armament: one hub-firing 37-mm gun, two 12.7-mm (0.5-in) machine-guns in nose decking, and four 7.62-mm (0.3-in) guns in the wings, plus provision for one 227-kg (500-lb) bomb under the fuselage

Originally designed as an interceptor, the Airacobra was used also at low level, where its hub-mounted 37-mm cannon was to prove most effective in ground attack. Soviet pilots, fighting at low level, also achieved considerable success in air combat.

USA

Curtiss P-40 Warhawk

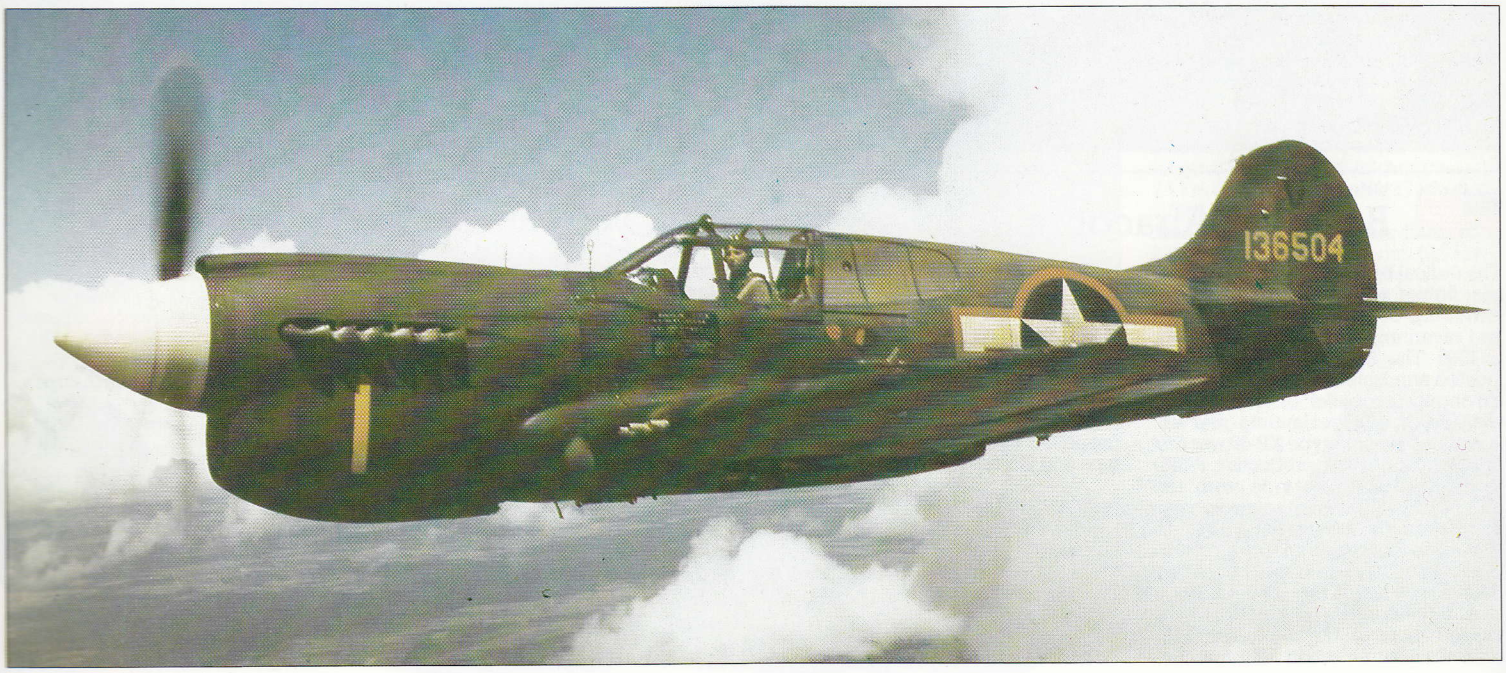
The USA's most important fighter at the time of the Japanese attack on Pearl Harbor, the **Curtiss P-40** continued to give valuable service for the remainder of the war, though it never matched the excellence of the famous P-38/P-47/P-51 trio. It had, after all, first flown as the **X17Y** (later the **P-36** with Pratt & Whitney R-1830 radial) and been re-engined as the **XP-40** with supercharged Allison V-1710 V-12 engine in October 1938. Large orders followed, but most **P-40A** aircraft went to the RAF (as the **Tomahawk Mk I**). The **P-40B** followed with cockpit armour and an armament of two 12.7-mm (0.5-in) and four 7.62-mm (0.3-in) guns (the **Tomahawk Mk IIA** in the RAF). The **P-40C** (**Tomahawk Mk IIB**) featured self-sealing fuel tanks. The **P-40D** introduced a slightly shortened nose with radiator moved forward and deepened, this marked change in appearance being identified by a change of name to **Kittyhawk** in the RAF (all P-40s in American service being termed **Warhawk**); the P-40D corresponded with the **Kittyhawk Mk I** in RAF service. The first major USAAF version was the **P-40E** (**Kittyhawk Mk IA**), with six 12.7-mm (0.5-in) wing guns, 2,320 being built. A Packard-built Rolls-Royce Merlin powered the **P-40F** (**Kittyhawk Mk II**). Most-produced version was the **P-40N** (of which 5,219 were built), this version reverting to the Allison V-1710 engine and featuring shackles for up to 680 kg (1,500 lb) of bombs; in RAF service it became the **Kittyhawk Mk IV**. The majority of USAAF P-40s served in the Pacific, although many served in the Mediterranean theatre alongside the Commonwealth Tomahawks and Kittyhawks. Total USAAF production was 12,014, 1,182 Tomahawks and 3,342 Kittyhawks being built on British contracts.

Specification

Curtiss P-40N-20 Warhawk (Kittyhawk Mk IV)

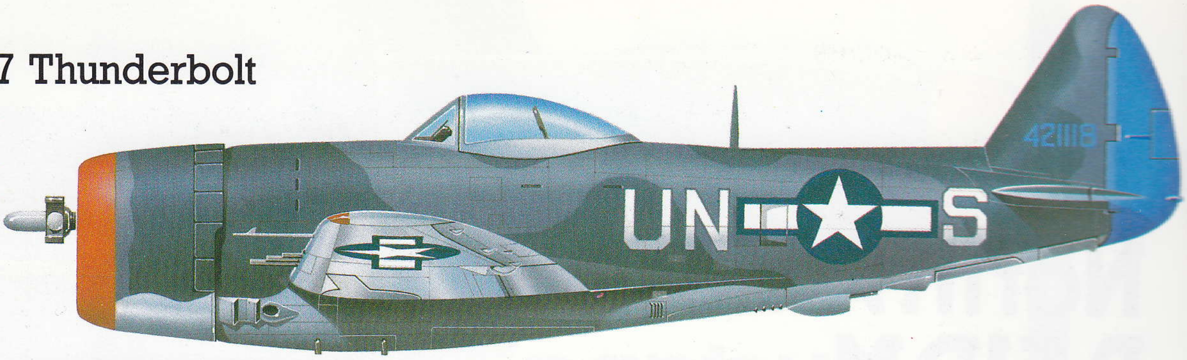
Type: single-seat fighter/fighter-bomber
Powerplant: one 1015-kW (1,360-hp) Allison V-1710-81 V-12 piston engine
Performance: maximum speed 609 km/h (378 mph) at 3200 m (10,500 ft); climb to 4570 m (15,000 ft) in 6.7 minutes; service ceiling 11580 m (38,000 ft); range 386 km (240 miles)
Weights: empty 2722 kg (6,000 lb); maximum take-off 5171 kg (11,400 lb)
Dimensions: span 11.38 m (37 ft 4 in); length 10.16 m (33 ft 4 in); height 3.76 m (12 ft 4 in); wing area 21.92 m^2 (236.0 sq ft)
Armament: six 12.7-mm (0.5-in) machine-guns in the wings, plus a bombload of up to three 227-kg (500-lb) bombs

The P-40E, seen here in 1942, was the first to serve extensively with the USAAF in Europe and North Africa. Called Kittyhawk in RAF service and Warhawk with the American forces, the P-40 bore the brunt of the initial fighting in the Pacific.



USA

Republic P-47 Thunderbolt



This P-47M Thunderbolt was based at Boxted in the UK in early 1945. It was operated by the 63rd FS in the famed 56th Fighter Group.

Evolved from Major Alexander P. de Seversky's radial-powered **P-43**, the big **Republic P-47 Thunderbolt** was designed under the leadership of Alexander Kartveli to become one of America's three outstanding fighters of the war. First flown on 6 May 1941, the **XP-47B** was designed around the 1492-kW (2,000-hp) Pratt & Whitney R-2800 with exhaust-driven turbocharger in the rear fuselage; armament was eight 12.7-mm (0.5-in) machine-guns in the wings. 171 production **P-47B** fighters were built with minor improvements and a top speed of 691 km/h (429 mph), this version being brought to the UK in January 1943 by the 56th and 78th Fighter Groups; they were first flown in combat on 8 April that year, flying escort for B-17s. Early P-47s proved to possess poor climb and manoeuvrability, but were popular on account of their ability to survive heavy battle damage. A lengthened fuselage and provision for an under-fuselage drop tank identified the **P-47C**. The major version (of which no fewer than 12,602 were built) was the **P-47D** with water-injection power boost, and cut-down rear fuselage with 'bubble' hood on later sub-variants; P-47Ds served in the UK, the Mediterranean and the Far East. In Burma 16 RAF squadrons flew the P-47B (as the **Thunderbolt Mk I**) and P-47D (**Thunderbolt Mk II**), a total of 826 being delivered. Developed as a result of demands for a 'sprint' version, the **P-47M** with improved turbocharger and a top speed of 762 km/h (473 mph) at 9755 m (32,000 ft) reached Europe at the end of 1944, while the **P-47N** with blunt-tipped enlarged wing and increased fuel capacity was developed purely for service in the Pacific; a total of 1,816 was produced and these flew escort for B-29s in their raids on Japan in 1945. A total of 15,675 P-47s was produced.

Specification

Republic P-47D-25 (Thunderbolt Mk II)

Type: single-seat long-range fighter

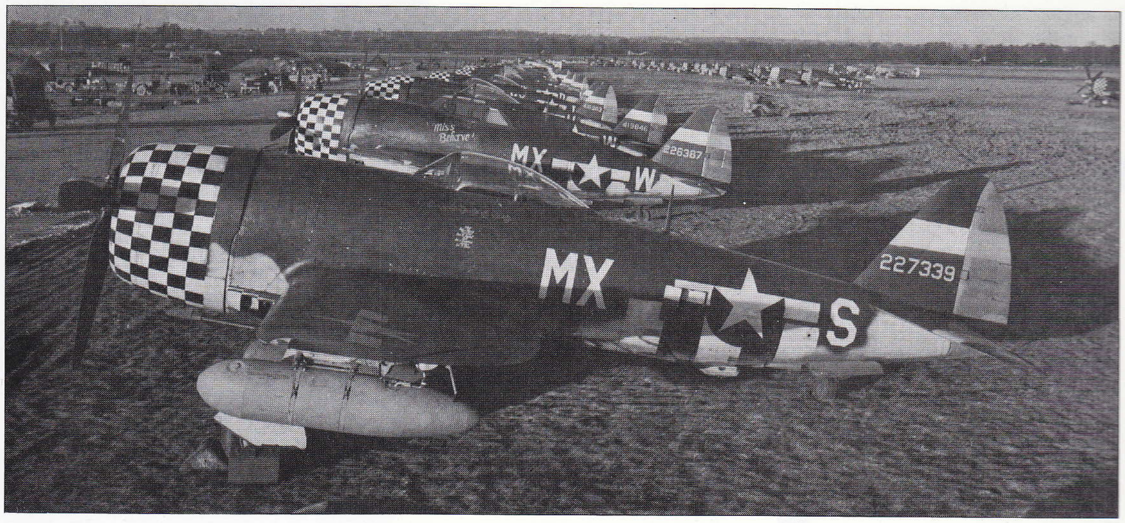
Powerplant: one 1716-kW (2,300-hp) Pratt & Whitney R-2800-59 radial piston engine

Performance: maximum speed 689 km/h (428 mph) at 9145 m (30,000 ft); climb to 6095 m (20,000 ft) in 9.0 minutes; service ceiling 12800 m (42,000 ft); maximum range 2028 km (1,260 miles)

Weights: empty 4536 kg (10,000 lb); maximum take-off 8800 kg (19,400 lb)

Dimensions: span 12.43 m (40 ft 9½ in); length 11.01 m (36 ft 1¾ in); height 4.32 m (14 ft 2 in); wing area 27.87 m² (300.0 sq ft)

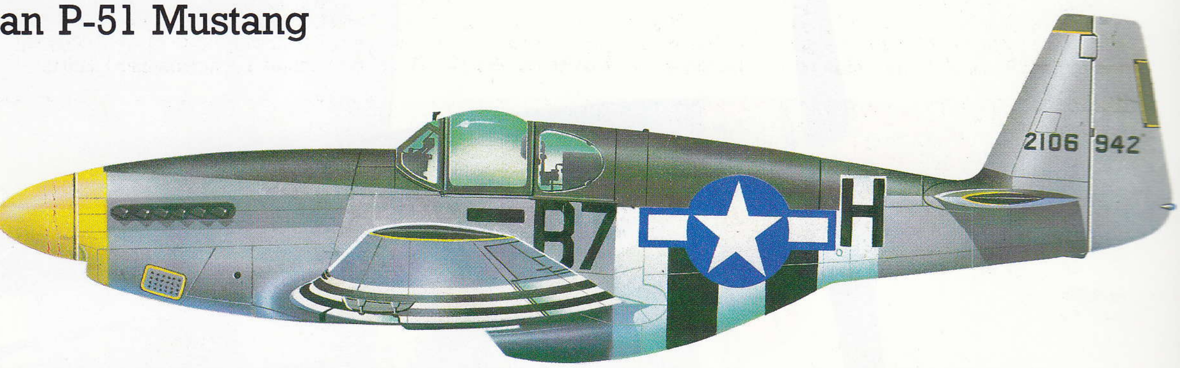
Armament: eight 12.7-mm (0.5-in) machine-guns in the wings, plus up to two 454-kg (1,000-lb) bombs



Fighters from the 82nd FS, 78th FG on the line after a mission over Germany in the autumn of 1944. Aircraft from this squadron claimed the first Me262 to be destroyed by the 8th Air Force on 29 August that year.

USA

North American P-51 Mustang



By the invasion of Normandy in June 1944, the Mustang was in extensive service with the USAAF. This P-51B operated out of Bottisham with the 374th FS, 361st FG, of the 8th Air Force over the invasion beaches.

One of the truly great fighters of the war, the **North American P-51 Mustang** was originally designed in 1940 to a British requirement. The prototype **NA-73** was first flown in October that year with a 820-kW (1,100-hp) Allison V-1710-F3F but, although two early aircraft were evaluated by the USAAF as **XP-51** aircraft, the type was not adopted by that air force. Most of the early aircraft were supplied to the RAF (620 aircraft as **Mustang Mk IA** and **Mustang Mk II**). Their outstanding low-level speed and range resulted in their assignment to the ground support (army co-operation) role. After the USA's entry into the war the USAAF adopted the aircraft, ordering 148 P-51s which had four 20-mm cannon (instead of four 0.5-in and four 0.3-in) wing bomb shackles in the attack category as the **A-36A**. The British in the meantime had re-engined four Mustangs with Rolls-Royce Merlins, and this expedient transformed the aircraft. In America the armament was reduced to four 12.7-mm (0.5-in) guns, all in the wings, and an 895-kW (1,200-hp) Allison V-1710-81 was used in the **P-51A**, 310 being ordered in 1942. So spectacular were the benefits of the Merlin that a Packard-built Merlin (as the V-1650) was used in the **P-51B**, of which 1,988 were produced at Inglewood; 1,750 of the similar **P-51C** were built at Dallas, Texas. Later aircraft had the armament restored to six guns, while increased fuel capacity extended the range to a maximum of 3347 km (2,080 miles), enabling Mustangs to escort American bombers to Berlin. The **P-51D** featured a cut-down rear fuselage and 'tear-drop' canopy. The Merlin P-51 joined the RAF as the **Mustang Mk III** (P-51B and P-51C) and **Mustang Mk IV** (P-51D). Fastest of all versions was the lightened **P-51H** with a top speed of 784 km/h (487 mph), 555 being built during the war. Total production of the P-51 was 15,586, including 7,956 P-51Ds and 1,337 generally similar **P-51K** fighters with an Aeroproducts propeller.

Specification

North American P-51D (Mustang Mk IV)

Type: single-seat long-range fighter

Powerplant: one 1112-kW (1,490-hp) Packard Rolls-Royce Merlin V-1650-7 V-12 piston engine

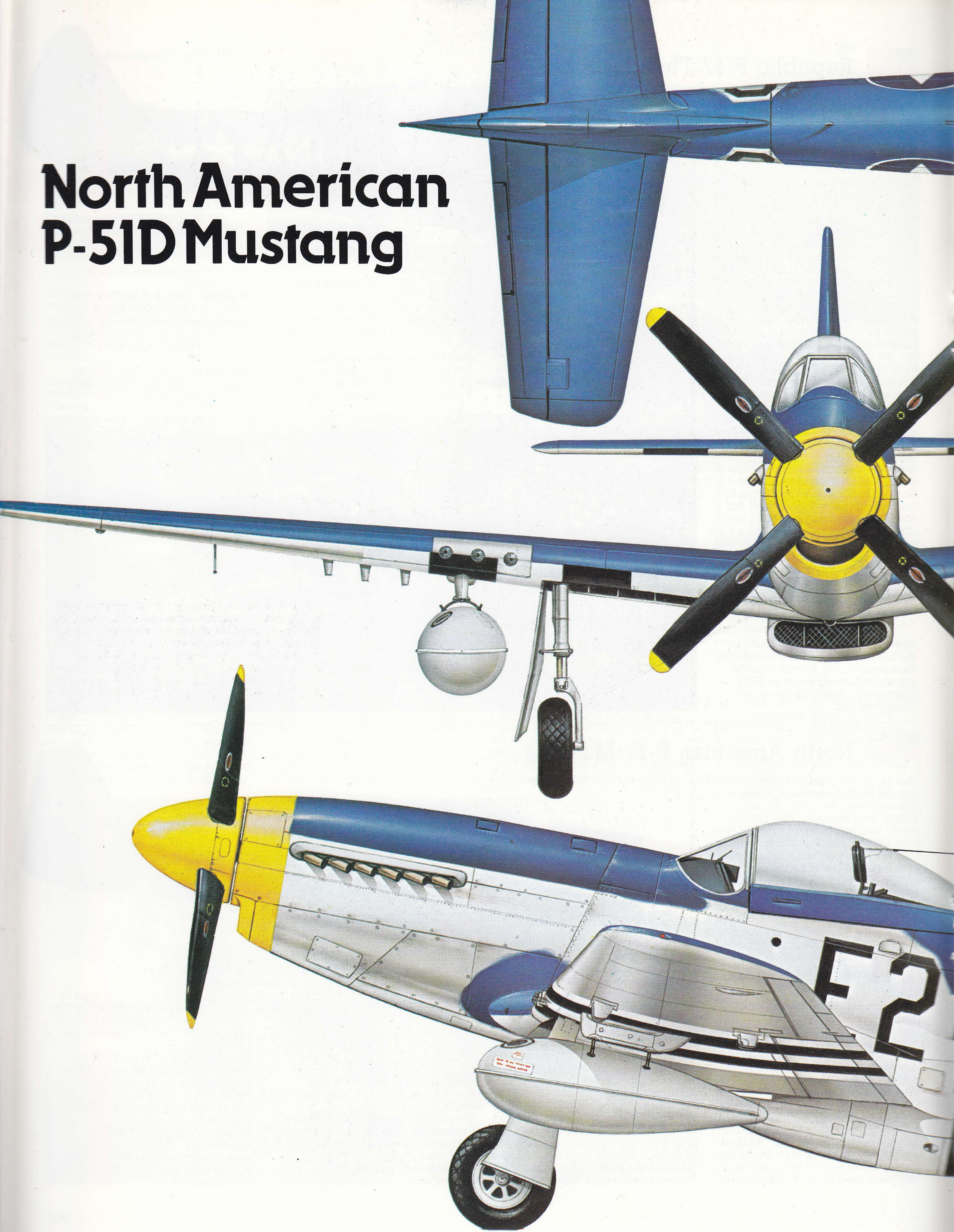
Performance: maximum speed 704 km/h (437 mph) at 7620 m (25,000 ft); climb to 9145 m (30,000 ft) in 13.0 minutes; service ceiling 12770 m (41,900 ft); maximum range 3347 km (2,080 miles)

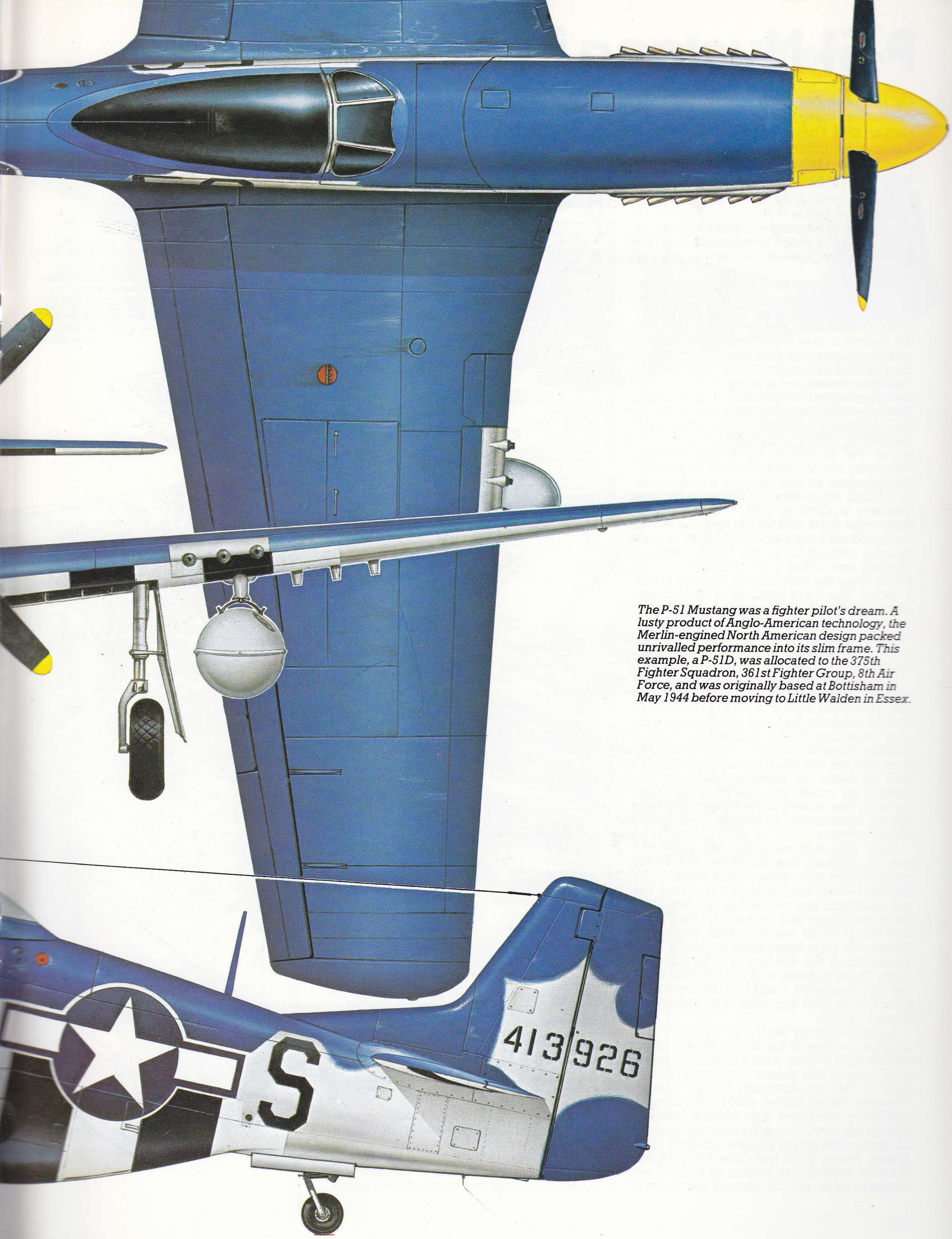
Weights: empty 3232 kg (7,125 lb); maximum take-off 5262 kg (11,600 lb)

Dimensions: span 11.28 m (37 ft 0¼ in); length 9.85 m (32 ft 3¾ in); height 3.71 m (12 ft 2 in); wing area 21.65 m² (233.2 sq ft)

Armament: six 12.7-mm (0.5-in) machine-guns in the wings, plus provision for up to two 454-kg (1,000-lb) bombs or six 127-mm (5-in) rocket projectiles

North American P-51D Mustang





The P-51 Mustang was a fighter pilot's dream. A lusty product of Anglo-American technology, the Merlin-engined North American design packed unrivalled performance into its slim frame. This example, a P-51D, was allocated to the 375th Fighter Squadron, 361st Fighter Group, 8th Air Force, and was originally based at Bottisham in May 1944 before moving to Little Walden in Essex.

P-51 Mustang in Action

On 13 December 1943 German radar controllers were plotting an American raid on Kiel. They were puzzled by one fast-moving group, however, until reports from their own pilots came in – the Mustang had arrived!

Widely regarded as the finest long-range single-seat escort fighter of World War II, the North American P-51 Mustang was designed from the outset to meet a British requirement, and only afterwards was it taken into service with the USAAF.

The Mustang was designed following a visit by the British Purchasing Mission, whose other purchases were versions of existing USAAF types. Design commenced in April 1940 and the prototype was flown five months later, a record achievement. The Mustang's performance proved far superior to any contemporary American aircraft, largely due to its laminar-flow wing and aerodynamically clean fuselage. The early Allison-engined Mustangs had a superb low-level performance but were handicapped at higher altitudes by their lack of power. For this reason the Allison Mustangs were used only on armed tactical reconnaissance missions, an RAF Mustang becoming the first Allied single-engined fighter to fly over Germany in October 1942. Four early Mustangs were fitted with Merlin engines and, as this produced a marked improvement in high-altitude performance, the Merlin-engined Mustang was ordered into production as the P-51B, using the licence-built Packard Merlin V-1650-7. The P-51B was built at North American's Inglewood plant, while aircraft built at Dallas were known as P-51Cs. The Merlin-engined Mustangs went on to see extensive operational service in both European and Pacific theatres, with the RAF and the USAAF.

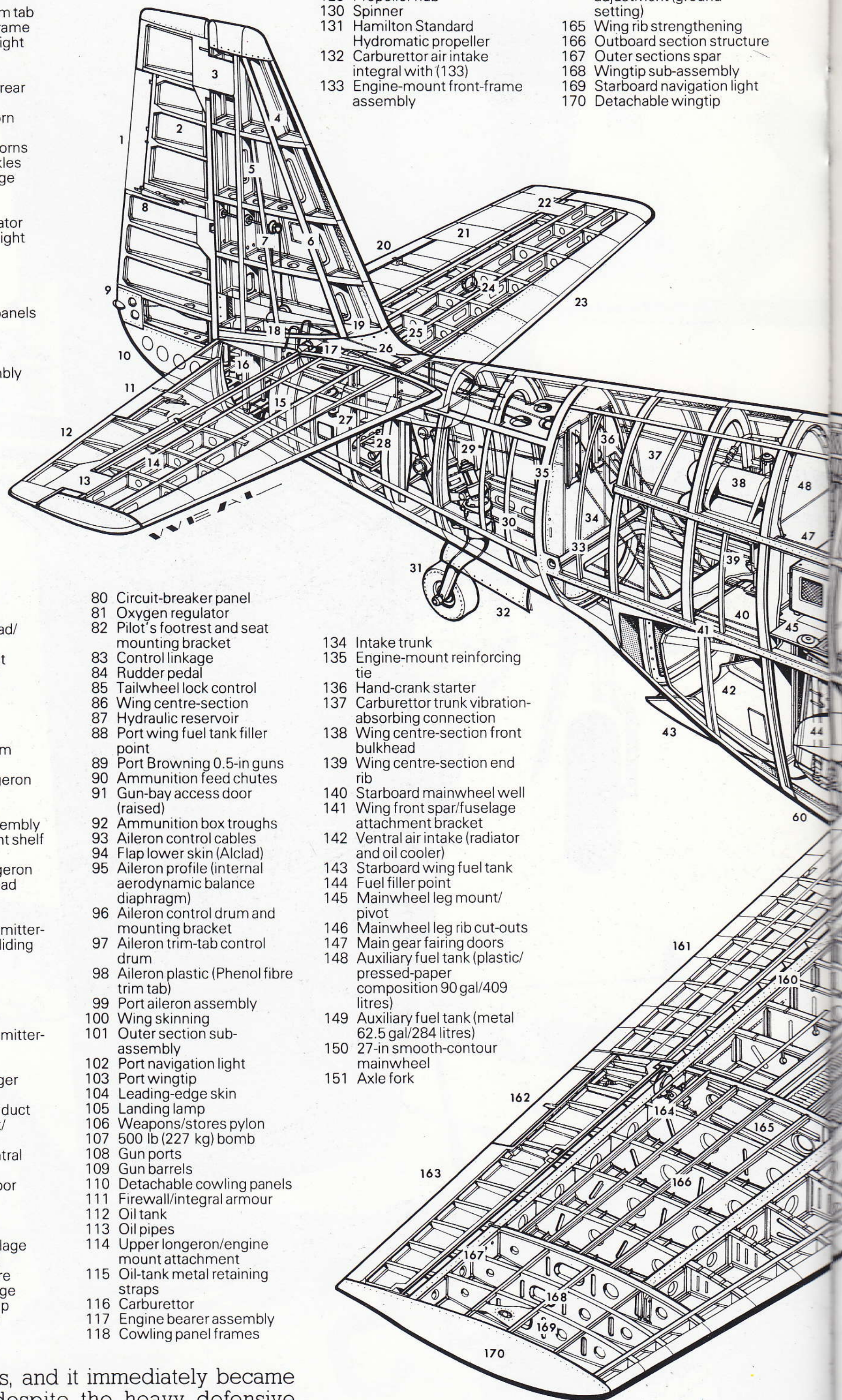
With straight-tapered and square-tipped wings of supposedly laminar section, the Mustang possessed superb handling characteristics, the generous flaps and wide-track landing gear providing it with outstanding landing qualities. Contributing to its exceptionally fine lines was the low-drag radiator bath located well aft under the fuselage, while the carburettor air intake, previously placed above the nose, was moved to the 'chin' position and served immediately to identify the Packard Merlin versions.

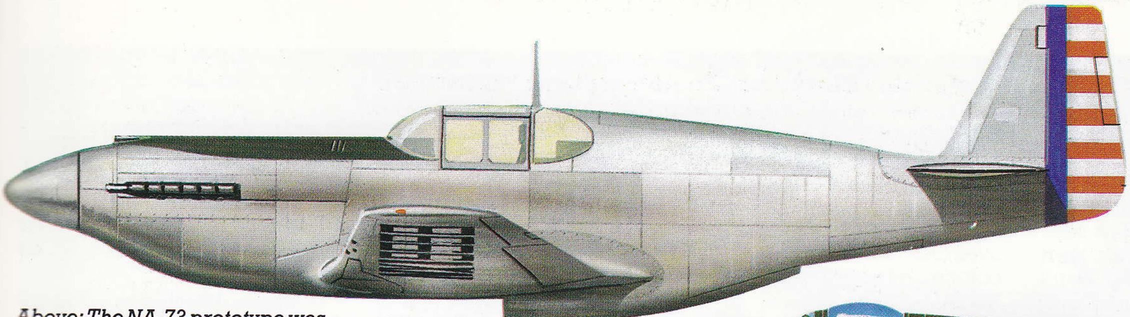
Early Allison-powered aircraft in USAAF service, originally designated the A-36 for the close-support role, were armed with two 20-mm and two 227-kg (500-lb) bombs. Four 0.5-in gun armament was retained in the new P-51B but in due course was increased in both P-51B and P-51C to six machine-guns; underwing racks could carry either a pair of 454-kg (1,000-lb) bombs or two 416-litre (110-US gal) drop tanks. These together with the vital rear fuselage tank bestowed a range of 3350 km (2,080 miles), far greater than other Allied fighters in Europe in 1943.

Air operations by the USAAF's 8th Air Force over Europe were at this stage of the war facing something of a crisis. After a number of 'rookie raids' against soft targets in northern France early in 1943, the American daylight bomber offensive moved farther afield, only to meet with bitter opposition from massed Luftwaffe fighters whose pilots quickly evolved devastating tactics, and began to take a heavy toll of the 10-man Boeing B-17s and Consolidated B-24s. Not even diversionary sweeps by P-47 fighter-bombers were able to distract the German fighter defences, and it immediately became obvious that, despite the heavy defensive armament of the bombers, escort fighters were the only remedy. Unfortunately the P-47 possessed inadequate range to accompany the bombers throughout their missions save for re-

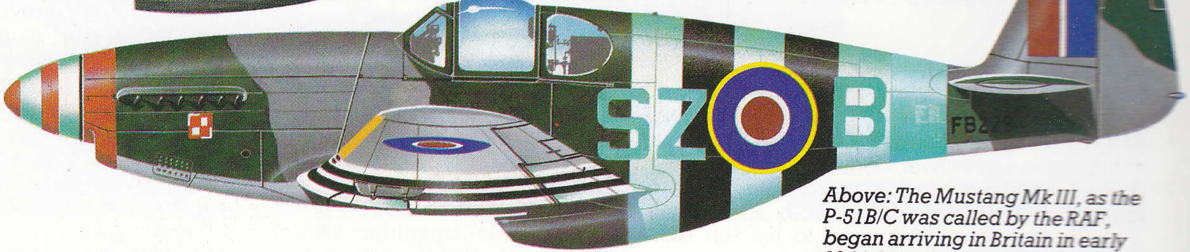
North American P-51B Mustang cutaway drawing key

1 Plastic (phenol fibre) rudder trim tab
2 Rudder frame (fabric covered)
3 Rudder balance
4 Fin front spar
5 Fin structure
6 Access panel
7 Rudder trim-tab actuating drum
8 Rudder trim-tab control link
9 Rear navigation light
10 Rudder metal bottom section
11 Elevator plywood trim tab
12 Starboard elevator frame
13 Elevator balance weight
14 Starboard tailplane structure
15 Reinforced bracket (rear steering stresses)
16 Rudder operating horn forging
17 Elevator operating horns
18 Tab control turnbuckles
19 Fin front spar/fuselage attachment
20 Port elevator tab
21 Fabric-covered elevator
22 Elevator balance weight
23 Port tailplane
24 Tab control drum
25 Fin root fairing
26 Elevator cables
27 Tab control access panels
28 Tailwheel steering mechanism
29 Tailwheel
30 Tailwheel leg assembly
31 Forward-retracting steerable tailwheel
32 Tailwheel doors
33 Lifting tube
34 Fuselage aft bulkhead/break point
35 Fuselage break point
36 Control cable pulley brackets
37 Fuselage frames
38 Oxygen bottles
39 Cooling-air exit flap actuating mechanism
40 Rudder cables
41 Fuselage lower longeron
42 Rear tunnel
43 Cooling-air exit flap
44 Coolant radiator assembly
45 Radio and equipment shelf
46 Power supply pack
47 Fuselage upper longeron
48 Radio bay aft bulkhead (plywood)
49 Fuselage stringers
50 SCR-695 radio transmitter-receiver (on upper sliding shelf)
51 Whip aerial
52 Junction box
53 Cockpit aft glazing
54 Canopy track
55 SCR-552 radio transmitter-receiver
56 Battery installation
57 Radiator/supercharger coolant pipes
58 Radiator forward air duct
59 Coolant header tank/radiator pipe
60 Coolant radiator ventral access cover
61 Oil-cooler air inlet door
62 Oil radiator
63 Oil pipes
64 Flap control linkage
65 Wing rear spar/fuselage attachment bracket
66 Crash pylon structure
67 Aileron control linkage
68 Hydraulic hand pump
69 Radio control boxes
70 Pilot's seat
71 Seat suspension frame
72 Pilot's head/back armour
73 Rearward-sliding clear-vision canopy
74 External rear-view mirror
75 Ring and bead gunsight
76 Bullet-proof windshield
77 Gyro gunsight
78 Engine controls
79 Signal-pistol discharge tube
80 Circuit-breaker panel
81 Oxygen regulator
82 Pilot's footrest and seat mounting bracket
83 Control linkage
84 Rudder pedal
85 Tailwheel lock control
86 Wing centre-section
87 Hydraulic reservoir
88 Port wing fuel tank filler point
89 Port Browning 0.5-in guns
90 Ammunition feed chutes
91 Gun-bay access door (raised)
92 Ammunition box troughs
93 Aileron control cables
94 Flap lower skin (Alclad)
95 Aileron profile (internal aerodynamic balance diaphragm)
96 Aileron control drum and mounting bracket
97 Aileron trim-tab control drum
98 Aileron plastic (Phenol fibre trim tab)
99 Port aileron assembly
100 Wing skinning
101 Outer section sub-assembly
102 Port navigation light
103 Port wingtip
104 Leading-edge skin
105 Landing lamp
106 Weapons/stores pylon
107 500 lb (227 kg) bomb
108 Gun ports
109 Gun barrels
110 Detachable cowling panels
111 Firewall/integral armour
112 Oil tank
113 Oil pipes
114 Upper longeron/engine mount attachment
115 Oil-tank metal retaining straps
116 Carburettor
117 Engine bearer assembly
118 Cowling panel frames
119 Engine aftercooler
120 Engine leads
121 1,520 hp Packard V-1650 (R-R Merlin) twelve-cylinder liquid-cooled engine
122 Exhaust fairing panel
123 Stub exhausts
124 Magneto
125 Coolant pipes
126 Cowling forward frame
127 Coolant header tank
128 Armour plate
129 Propeller hub
130 Spinner
131 Hamilton Standard Hydromatic propeller
132 Carburettor air intake integral with (133)
133 Engine-mount front-frame assembly
134 Intake trunk
135 Engine-mount reinforcing tie
136 Hand-crank starter
137 Carburettor trunk vibration-absorbing connection
138 Wing centre-section front bulkhead
139 Wing centre-section end rib
140 Starboard mainwheel well
141 Wing front spar/fuselage attachment bracket
142 Ventral air intake (radiator and oil cooler)
143 Starboard wing fuel tank
144 Fuel filler point
145 Mainwheel leg mount/pivot
146 Mainwheel leg rib cut-outs
147 Main gear fairing doors
148 Auxiliary fuel tank (plastic/pressed-paper composition 90 gal/409 litres)
149 Auxiliary fuel tank (metal 62.5 gal/284 litres)
150 27-in smooth-contour mainwheel
151 Axle fork
152 Towing lugs
153 Landing-gear fairing
154 Main-gear shock strut
155 Blast tubes
156 Wing front spar
157 Gun bay
158 Ammunition feed chutes
159 Ammunition boxes
160 Wing rear spar
161 Flap structure
162 Starboard aileron tab
163 Starboard aileron
164 Starboard aileron tab adjustment (ground setting)
165 Wing rib strengthening
166 Outboard section structure
167 Outer sections spar
168 Wingtip sub-assembly
169 Starboard navigation light
170 Detachable wingtip

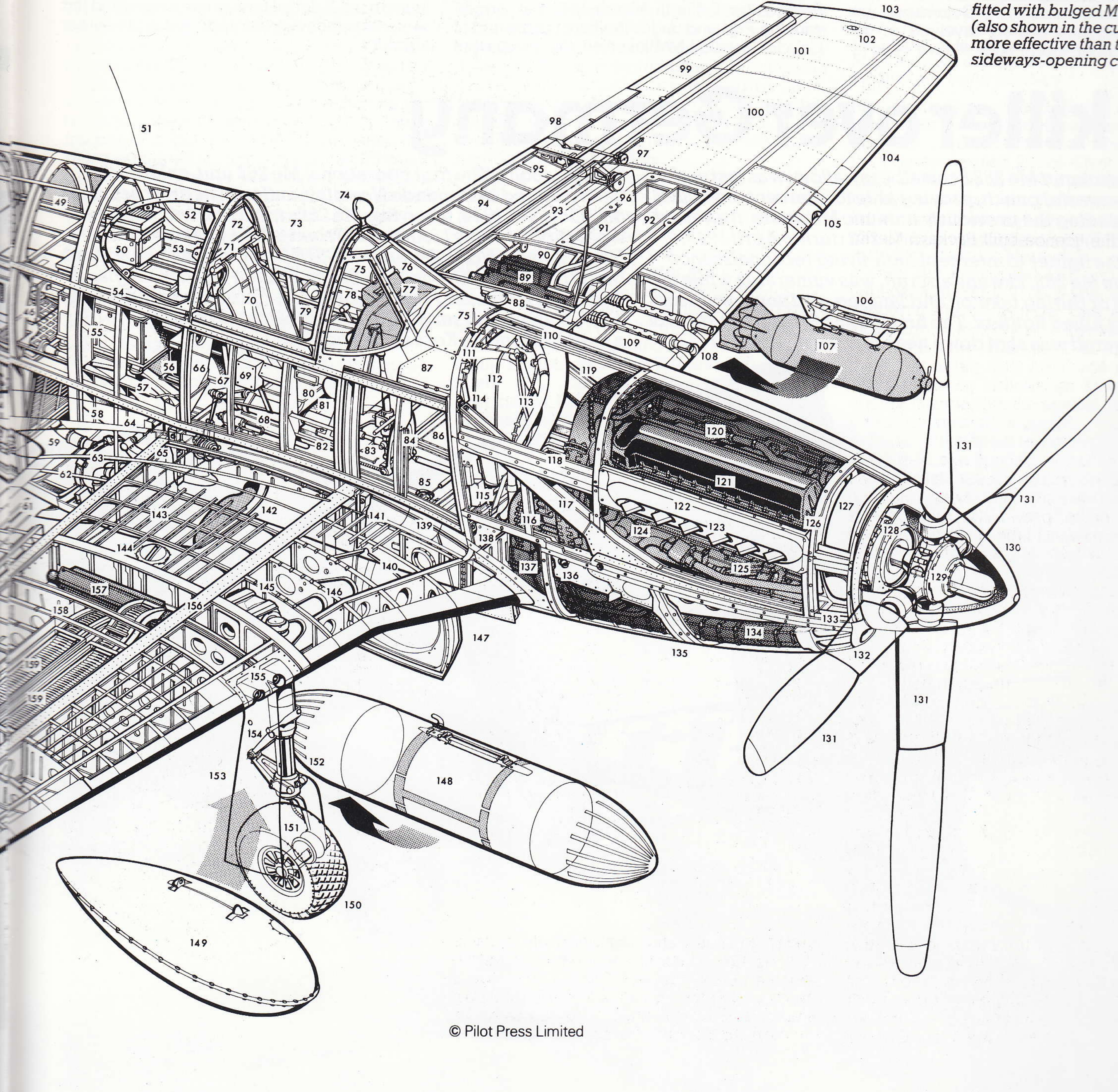




Above: The NA-73 prototype was built to a British purchasing commission requirement in only 117 days. Powered by an 1100-hp (820-kW) Allison engine, the result was an aircraft of obviously outstanding potential but disappointing performance.



Above: The Mustang Mk III, as the P-51B/C was called by the RAF, began arriving in Britain in early 1944. Most RAF versions were retro-fitted with bulged Malcolm hoods (also shown in the cutaway), much more effective than the original sideways-opening canopy.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latively short-distance raids. The crisis arrived during a single week in mid-August 1943 when in raids on Schweinfurt, Regensburg and Bordeaux the 8th Air Force suffered the loss of more than 300 B-17s. Coming at a time when the USAAF was desperately working to build up a really large force of bombers with which to hit Germany, such losses were regarded as near-catastrophic. For a time easier targets were chosen until on 14 October the 8th Air Force returned to Schweinfurt, but once more lost 60 bombers.

First arrival

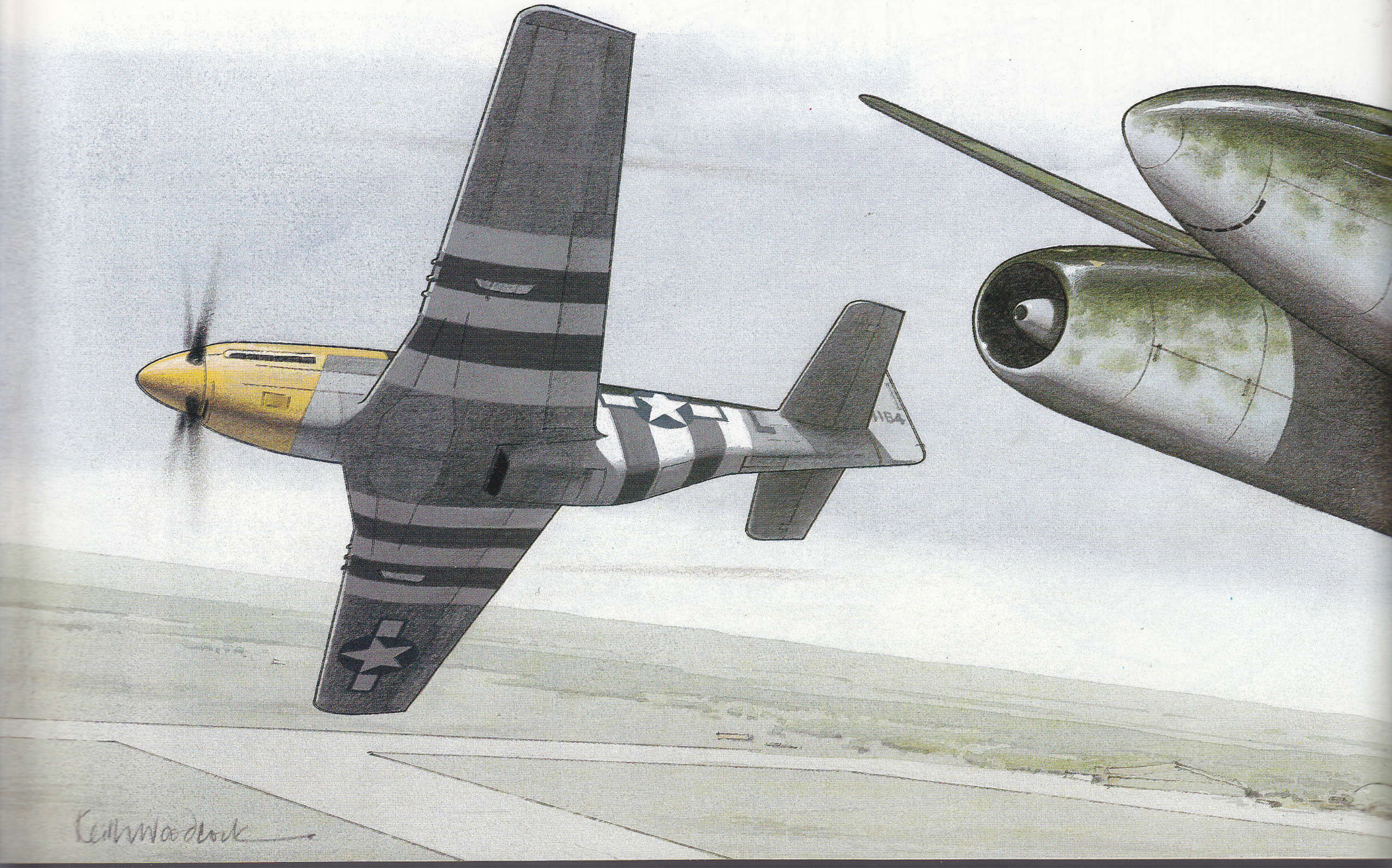
That month, however, saw the first P-51Bs arrive in England when the 354th Fighter Group under Colonel Kenneth R. Martin moved into Greenham Common, and the following month took up its operational base at Boxted, fielding the 353rd, 355th and 356th Fighter Squadrons. Assigned to the 9th Air Force, the 354th Group flew its first sweep over north western France on 1 December, but thereafter became closely involved in developing bomber-escort tactics. Five days later the group escorted daylight bombers to Amiens. On 13 December the P-51s flew with the bombers all the way to Kiel, at that time the longest American fighter sortie of the war. And on 11 January 1944 a 354th pilot, Major James H. Howard, won the Medal of Honor for his single-handed efforts to protect a bomber formation against a large number of Luftwaffe fighters over Germany; the following month, promoted colonel, Howard assumed command of the 354th.

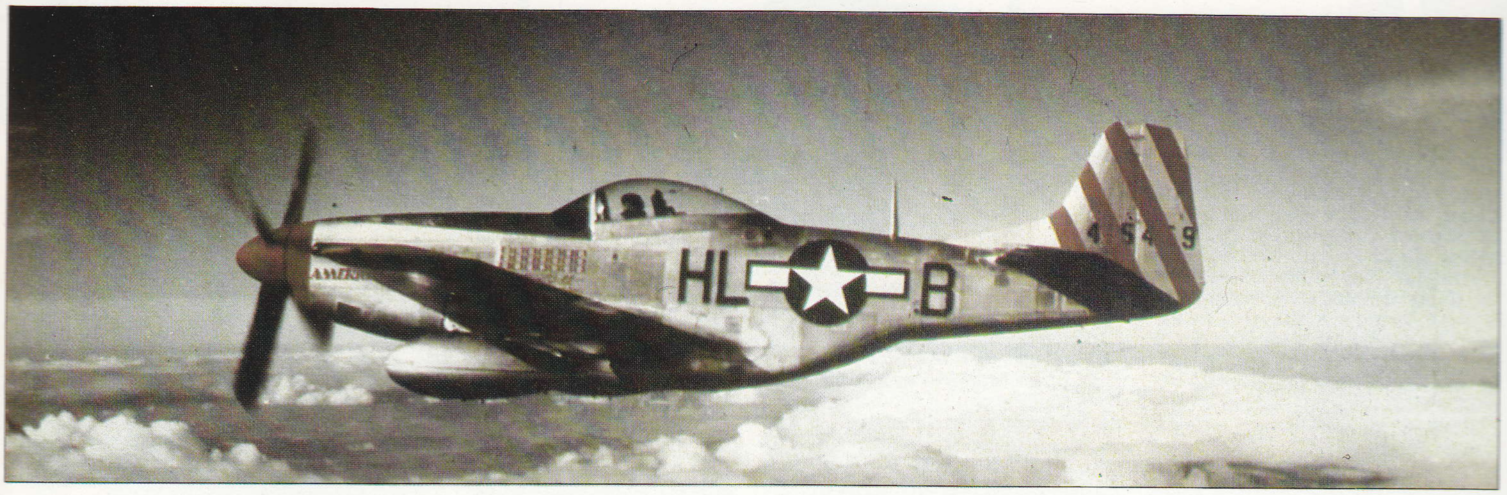
On 22 February the second 9th Air Force P-51 group, the 363rd at Rivenhall, became operational, joining the first 8th Air Force Mustang group, the 357th based at Leiston, which had flown its first sweep over Rouen 11 days earlier. Before February was out one of the 8th Air Force's most famous fighter groups, the 4th was also operational in the P-51B; originally formed in August 1942 by embracing the three ex-RAF 'Eagle' squadrons (Nos 71, 121 and 133), the 4th Fighter Group had traded its Spitfires for P-47s in March 1943 but, armed with the P-51 and under the initial command of Colonel Donald J.M. Blakeslee, the group went on to destroy more enemy aircraft on the ground and in the air than any other 8th Air Force fighter group. Blakeslee received his first P-51Bs on 27 February and, in accordance with a promise given to General William E. Kepner, commanding the VIII Fighter Command, to have them in action within 24 hours, led them over Europe the following day; their pilots had an average of less than an hour's flying experience on the aircraft!

The P-51B and P-51C remained the main in-service variants in Europe (where they also served with the 31st, 52nd, 325th and 332nd Groups of the 12th and 15th Air Forces in the Mediterranean theatre) until mid-1944, when the improved P-51D started arriving. This version, of which 7,956 examples were produced (6,502 at Inglewood), featured a cut-down rear fuselage and single-piece sliding canopy which gave much enhanced rear vision for the pilot, while the six-gun armament was standardized. After the first few aircraft had been delivered a small dorsal fin was introduced and this was retrospectively incorporated in the earlier aircraft.

Jet killer over Germany

The Messerschmitt Me 262 Schwalbe (swallow) was fast and packed a powerful punch, proving able to intercept any Allied aircraft including the previously immune Mosquito. It entered service with Erprobungskommando 262 during April 1944, who used the fighter to intercept high-flying reconnaissance aircraft. The Me 262, like any aircraft, was vulnerable while on the ground or during take-off and landing, and some were lost to prowling Allied fighters. The first Me 262 to fall to the guns of another aircraft was shot down near Brussels by two P-47 Thunderbolts. The first operational Me 262 unit, enlarged and renamed Kommando Nowotny, suffered its first casualties on 3 October 1944, when two Me 262s taking off from Achmer were shot down by Lieutenant Urban L. Drew. Lieutenant Drew, flying a North American P-51D Mustang, was a pilot with the 361st Fighter Group then based at Little Walden, England. The superb Mustang was probably the finest American fighter of the war, seeing service in every theatre and going on to play a major role in the Korean conflict.





Top-scoring USAAF pilot in the Mediterranean, Captain John J. Voll, is seen with 21 kills marked on his P-51D. Captain Voll flew out of Mondolfo with the 308th Fighter Squadron, 31st Fighter Group. Many missions consisted of escort for 15th AF medium and heavy bombers.

On 6 March 1944 8th Air Force P-51s of the 357th Group accompanied B-17s and B-24s all the way to Berlin, their presence keeping bomber losses from enemy fighters to acceptable proportions. Thereafter, as Luftwaffe losses began to mount steeply as the result of increasing attacks by American fighters over the German homeland, the P-51 came to be employed more frequently in the ground-attack role, eventually being equipped with rockets (either six infantry-type Bazookas or 127-mm/5-in projectiles) under the wings. However, right up to the end of the war in Europe P-51s continued to provide escort for the heavy bombers, even accompanying them all the way to the Soviet Union on the small number of daylight shuttle raids. In the intercept role the P-51 proved to be murderous and, during the famous *Bodenplatte* attack of New Year's Day 1945, when about 50 Luftwaffe fighter-bombers attacked its base in Belgium, the 352nd Fighter Group claimed about half the attackers without loss.

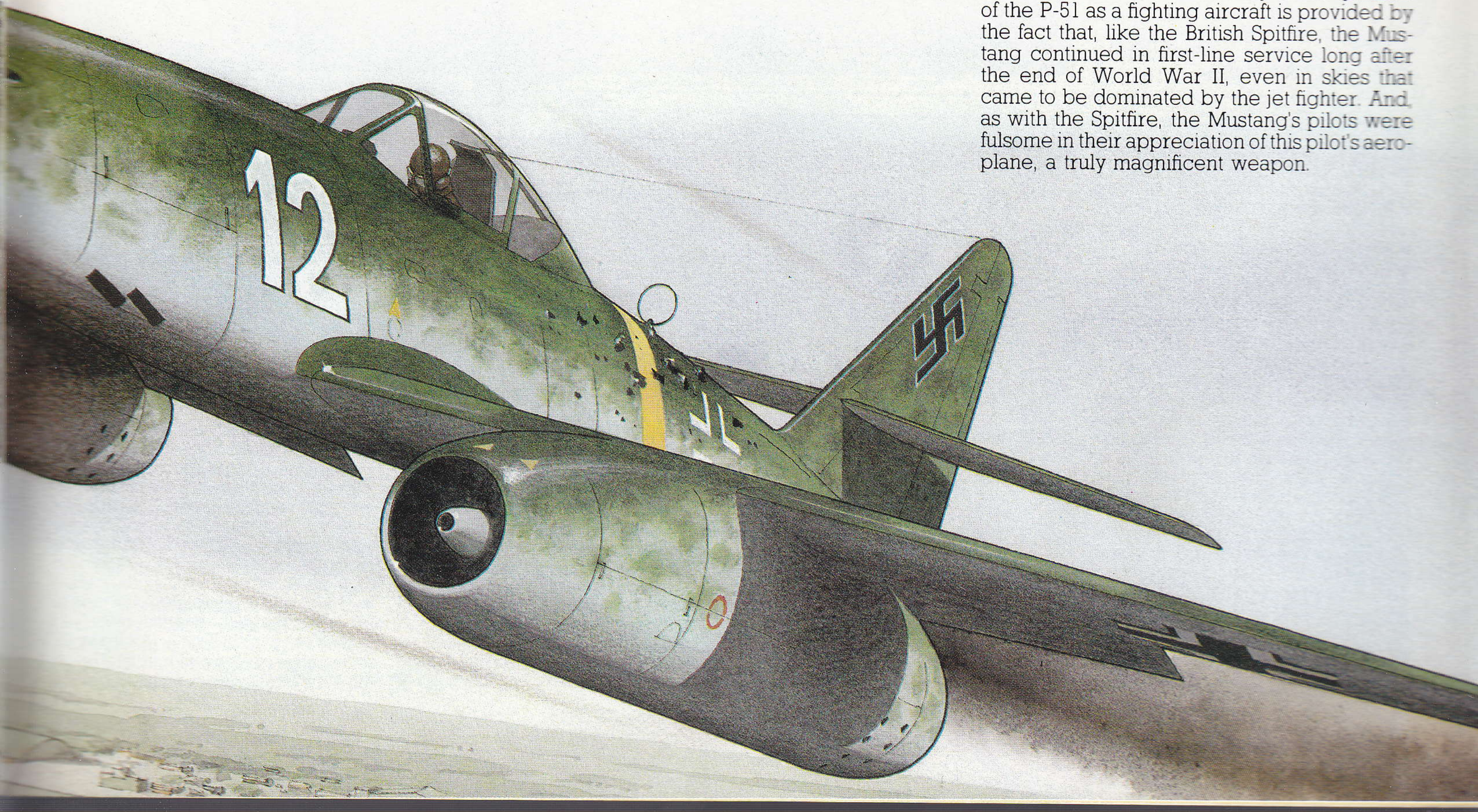
Unquestionably the best-known P-51 pilot in Europe was Captain Don Gentile, one of the 4th Fighter Group's ex-RAF pilots who had set out to beat Rickenbacker's World War I victory score of 26. This colourful pilot had reached a score of 21 victories by mid-April 1944, together with an impressive collection of medals, but then committed the cardinal sin of crashing during unauthorized low-level aerobatics over Debden.

While the achievements of the USAAF's Mustangs were perhaps most spectacular over northern Europe, these were by no means the limit of the P-51's combat service, although by the war's end the Mustang equipped all but one of the 8th Air Force's fighter groups. The RAF received some 800 Allison-powered Mustang Mk Is, IAs and IIs, while Merlin-powered Mustang Mk IIIs and IVs, which equipped 18 home-based RAF squadrons and six in the Mediterranean, numbered about 770 and 890 respectively.

In the Far East the P-51B and P-51C entered service in the CBI (China-Burma-India) theatre in September 1943 with the 23rd Fighter Group (the 'Flying Tigers'), and during the Japanese offensive in the Tungtin Hu region of November that year gave much-needed close support to the Chinese ground forces. Over Burma A-36s and P-51Bs of the 311th Fighter Group escorted bombing raids over Rangoon and strafed Japanese airfields at Myitkyina and Bhamo, and in July 1944 supported Allied ground forces, including Merrill's Marauders.

Over the Pacific the 15th and 21st Fighter Groups received P-51Ds in late 1944 in time to support the invasion of Iwo Jima, and later provided fighter escort for the tremendous Boeing B-29 raids over Japan itself. In April and May the P-51s of the 20th Air Force were sent to strike Japanese airfields on Kyushu to curtail enemy suicide attacks against the American invasion forces at Okinawa.

Perhaps the finest testimony to the qualities of the P-51 as a fighting aircraft is provided by the fact that, like the British Spitfire, the Mustang continued in first-line service long after the end of World War II, even in skies that came to be dominated by the jet fighter. And, as with the Spitfire, the Mustang's pilots were fulsome in their appreciation of this pilot's aeroplane, a truly magnificent weapon.

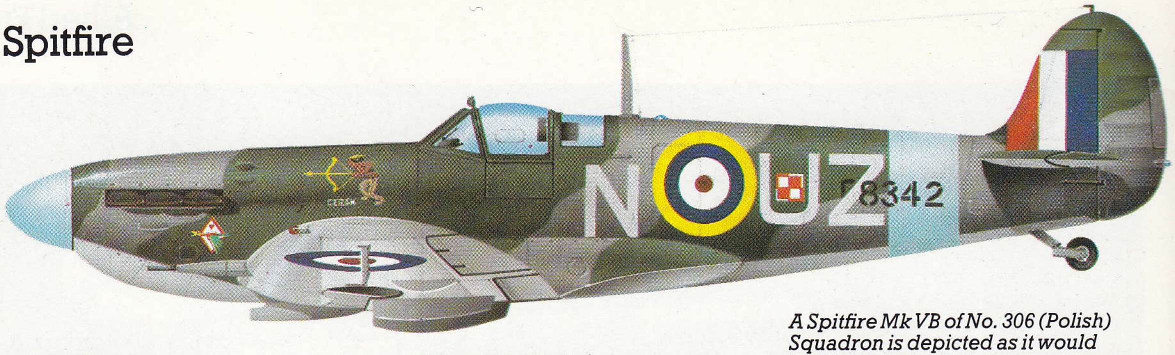


UK

Supermarine Spitfire

Classic creation of designer R.J. Mitchell, the **Supermarine Spitfire** was the descendant of the race-winning Schneider Trophy seaplanes. First flown on 5 March 1936, the **Spitfire Mk I** with Merlin II engine and eight machine-guns entered RAF service in August 1938, this version being heavily committed to combat in the Battle of Britain. The **Spitfire Mk II** with Merlin XII followed in September 1940, the **Spitfire Mk IIB** being armed with two 20-mm guns and four machine-guns. The photo-reconnaissance **Spitfire Mk IV** was followed in March 1941 by the excellent **Spitfire Mk V** (of which 6,479 were produced) with 1074-kW (1,440-hp) Merlin 45; the **Spitfire Mk VC** fighter-bomber could carry one 227-kg (500-lb) or two 113-kg (250-lb) bombs. The **Spitfire Mk VB** remained the mainstay of Fighter Command between mid-1941 and mid-1942 when the **Spitfire Mk IX**, with 1238-kW (1,660-hp) Merlin 61 with two-stage, two-speed supercharger joined the RAF. The **Spitfire Mk VI** and **Spitfire Mk VII** were high-altitude fighters with extended wingtips, but the definitive **Spitfire Mk VIII** fighter and fighter-bomber was used principally in the Mediterranean and Far East, being fully tropicalized

The **Spitfire Mk X** and **Spitfire Mk XI** were unarmed photo-reconnaissance versions and the **Spitfire Mk XVI**, with a top speed of 652 km/h (405 mph) was produced in fighter and fighter-bomber versions. All the foregoing (of which 18,298 were built) were powered by the Rolls-Royce or Packard Merlin, and the first with 1294-kW (1,735-hp) Griffon IV was the **Spitfire Mk XII**, introduced in 1943 to counter the Fw 190 fighter-bomber. It was followed by the 1529-kW (2,050-hp) Griffon 65-powered **Spitfire Mk XIV** fighter and fighter-bomber. The fighter-reconnaissance **Spitfire Mk XVIII** was just joining the RAF at the end of the war and had a top speed of 712 km/h (442 mph). In the Fleet Air Arm **Seafire** variants also served in large numbers with both Merlin and Griffon engines. Total production of the Spitfire was 20,351, plus 2,334 Seafires.



A Spitfire Mk VB of No. 306 (Polish) Squadron is depicted as it would have looked on Fighter Command's 'Rhubarb' sweeps over occupied France.

Specification

Supermarine Spitfire Mk VB

Type: single-seat interceptor fighter

Powerplant: one 1074-kW (1,440-hp) Rolls-Royce Merlin 45/46/50 V-12 piston engine

Performance: maximum speed 602 km/h (374 mph) at 3960 m (13,000 ft); climb to 6095 m (20,000 ft) in 7.5 minutes; service ceiling 11280 m (37,000 ft); range on internal fuel 756 km (470 miles)

Weights: empty 2313 kg (5,100 lb); maximum take-off 3078 kg (6,785 lb)

Dimensions: span 11.23 m (36 ft 10 in); length 9.11 m (29 ft 11 in); height 3.48 m (11 ft 5 in); wing area 22.48 m^2 (242.0 sq ft)

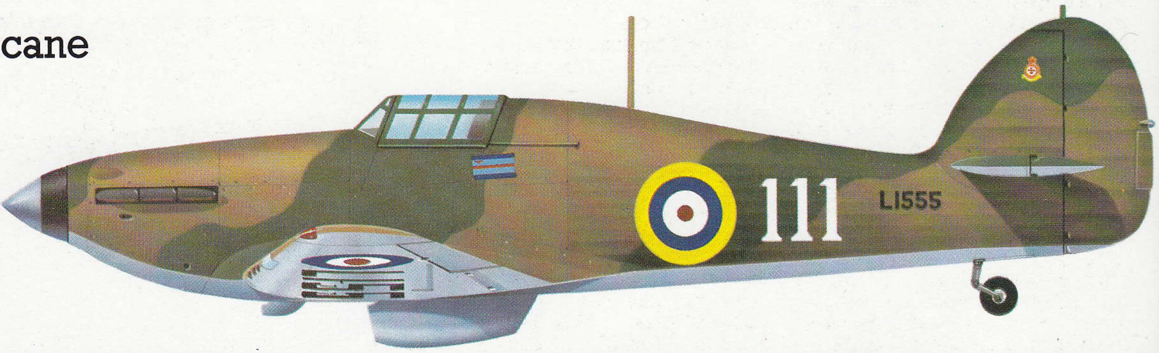
Armament: two 20-mm cannon and four 7.7-mm (0.303-in) machine-guns in the wings

Two Spitfire Mk IXs are seen over Anzio in January 1944. The Mk IX was a hasty adaptation of the Mk V airframe to accept a Merlin 61 engine. Nevertheless, 5,665 were built, second in numbers only to the Mk V.

UK

Hawker Hurricane

The first monoplane fighter and the first with a top speed of over 483 km/h (300 mph) to enter RAF service, the **Hawker Hurricane** was designed by Sydney Camm and first flown on 6 November 1935, joining the RAF in December 1937. The **Hurricane Mk I** with 768-kW (1,030-hp) Rolls-Royce Merlin II and an armament of eight 7.7-mm (0.303-in) machine-guns was Fighter Command's principal fighter in the Battle of Britain in 1940, and destroyed more enemy aircraft than all other defences combined. It was followed by the **Hurricane Mk IIA** with 955-kW (1,280-hp) Merlin XX before the end of 1940, the **Hurricane Mk IIB** with 12 machine-guns and the **Hurricane Mk IIC** with four 20-mm cannon during 1941. These versions were also able to carry up to two 227-kg (500-lb) bombs, drop tanks or other stores under the wings; they served as fighters, fighter-bombers, night-fighters, intruders and photo-reconnaissance aircraft on all fronts until 1943, and in the Far East until the end of the war. The **Hurricane Mk IID** introduced the 40-mm anti-tank gun in 1942. Two of these weapons were carried under the wings, and this version was particularly successful in North Africa. The **Hurricane Mk IV** featured a 'universal wing' which allowed carriage of up to eight 27.2-kg (60-lb) rocket projectiles or any of the external stores carried by the Mk II. It is believed 14,231 Hurricanes were produced, including 1,451 built in Canada (**Hurricane Mks X, XI** and **XII**). This total, also included many **Sea Hurricane** models of which early versions were catapulted from merchant ships and flown from converted merchant aircraft carriers, and later served aboard Royal Navy fleet carriers. Always regarded as somewhat slow among RAF fighters, the Hurricane was highly manoeuvrable and capable of withstanding considerable battle damage.



In February 1938, Squadron Leader J. W. Gillan of No. 111 Squadron flew his then-brand-new Hurricane from Edinburgh to Northolt, averaging 657 km/h (408 mph) with a tail wind.

Specification

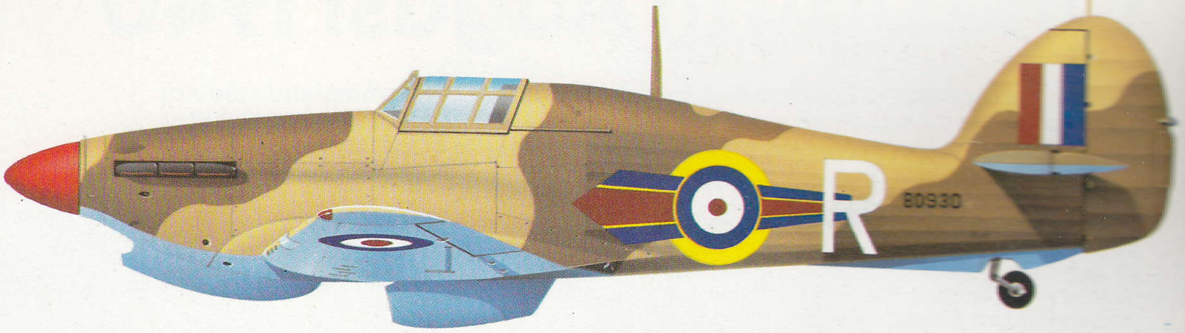
Hawker Hurricane Mk IIC

Type: single-seat fighter and fighter-bomber

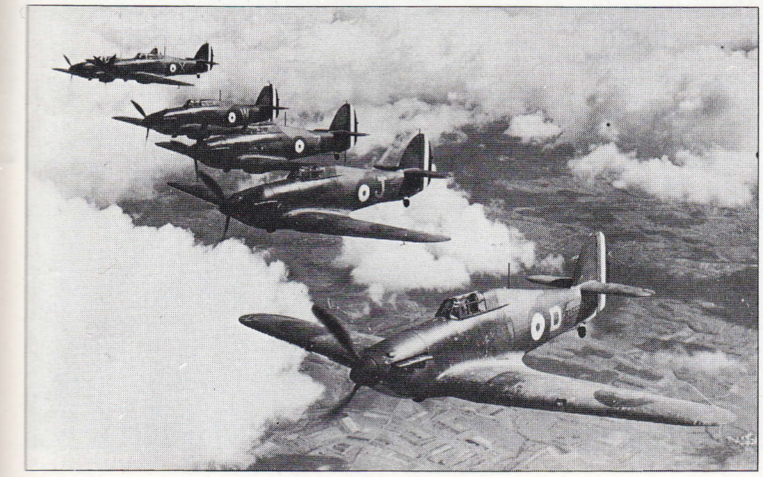
Powerplant: one 955-kW (1,280-hp) Rolls-Royce Merlin XX V-12 piston engine

Performance: maximum speed 541 km/h (336 mph) at 3810 m (12,500 ft); climb to 6095 m (20,000 ft) in 9.1 minutes; service ceiling 10850 m (35,600 ft); range on internal fuel

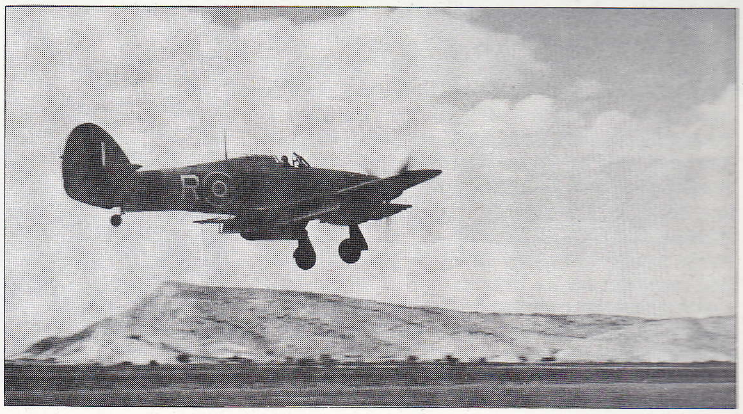
740 km (460 miles)
Weights: empty 2631 kg (5,800 lb); maximum take-off 3674 kg (8,100 lb)
Dimensions: span 12.19 m (40 ft 0 in); length 9.75 m (32 ft 0 in); height 3.99 m (13 ft 1 in); wing area 23.92 m² (257.5 sq ft)
Armament: four 20-mm cannon in wings, plus provision for two 227-kg (500-lb) bombs, or eight 27.2-kg (60-lb) rocket projectiles or two 409-litre (90-Imp gal) drop tanks under the wings



A Hurricane Mk IIB operating with No. 73 Squadron as seen in the Western Desert in 1942. The scheme is unusual in that the squadron has retained its pre-war marking.



A formation from No. 73 Squadron is seen over France in the early days of the war. The squadron formed part of the AASF (Advanced Air Striking Force) and was heavily involved in the fighting during May and June 1940, moving from base to base away from the advancing Wehrmacht.



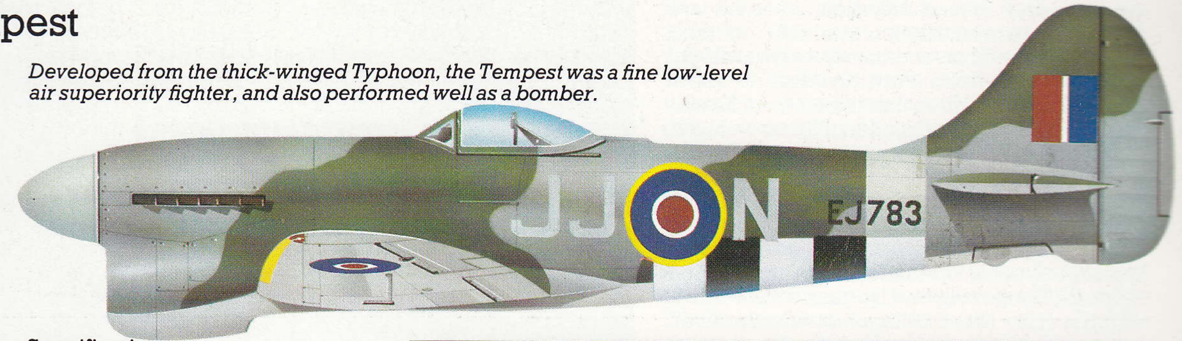
Hurricanes were used widely throughout the Mediterranean theatre. Initially they provided fighter cover, but as more capable fighters such as the Spitfire became available they switched to ground attack. From 1942 onwards, unguided rockets became favourite weapons.

UK

Hawker Tempest

Conscious that the Typhoon left much to be desired as an interceptor fighter as soon as it flew in 1940, Sydney Camm initiated the development of an improved version with a laminar-flow elliptical wing and a lengthened fuselage to accommodate more fuel. This aircraft, the **Hawker Tempest**, was first flown on 2 September 1942 and was followed by production **Tempest Mk V** aircraft which joined Nos 3 and 486 Squadrons in April 1944. The early aircraft **Tempest Mk V Series 1**, were armed with four long-barrelled 20-mm Hispano Mk II cannon, but the **Tempest Mk V Series 2** featured improved short-barrelled Mk V guns. Tempests were first committed to combat when the German flying-bomb offensive opened immediately after the Normandy landings, and the type shot down 638 out of the RAF's total of 1,771 bombs destroyed. Meanwhile, like the Typhoon, Tempests were being employed in the ground-attack role, being equipped to carry up to two 454-kg (1,000-lb) bombs, drop tanks or eight 27.2-kg (60-lb) rocket projectiles. However, with its top speed of 686 km/h (426 mph), the Tempest also proved an effective fighter against the new German aircraft then being introduced, and there were several instances of their shooting down Messerschmitt Me 262 jet fighters. The Tempest Mk V equipped 12 wartime RAF squadrons, 800 aircraft being completed (and 1,200 cancelled at the end of the war). The superb Bristol Centaurus-powered **Tempest Mk II**, although flying well before the end of hostilities, was too late to see action but served in the post-war RAF.

Developed from the thick-winged Typhoon, the Tempest was a fine low-level air superiority fighter, and also performed well as a bomber.



Specification

Hawker Tempest Mk V
Type: single-seat interceptor/ground attack fighter
Powerplant: one 1626-kW (2,180-hp) Napier Sabre II H-24 piston engine
Performance: maximum speed 685 km/h (426 mph) at 5640 m (18,500 ft); climb to 4570 m (15,000 ft) in 5.0 minutes; service ceiling 11580 m (38,000 ft); range on internal fuel 1190 km (740 miles)
Weights: empty 4082 kg (9,000 lb); maximum take-off 6142 kg (13,540 lb)
Dimensions: span 12.50 m (41 ft 0 in); length 10.26 m (33 ft 8 in); height 4.90 m (16 ft 1 in); wing area 28.06 m² (302.0 sq ft)
Armament: four 20-mm cannon in wings, plus provision for two 454-kg (1,000-lb) bombs, or eight 27.2-kg (60-lb) 7.62-cm (3-in) rocket projectiles or long-range fuel tanks

June 1944, and a Tempest pilot playfully buzzes his squadron mates. At this time, the Tempest was using its low-level performance to combat the flying-bomb menace. Nearly 640 V-1s were destroyed by the type.

One Day in August 1940

The story of the Battle of Britain is well known now, both in the mythical and scholarly versions. Nevertheless, it remains a struggle in which the RAF had to avoid defeat to ensure the survival of the nation. This is the story of just one of the days at the height of the conflict.

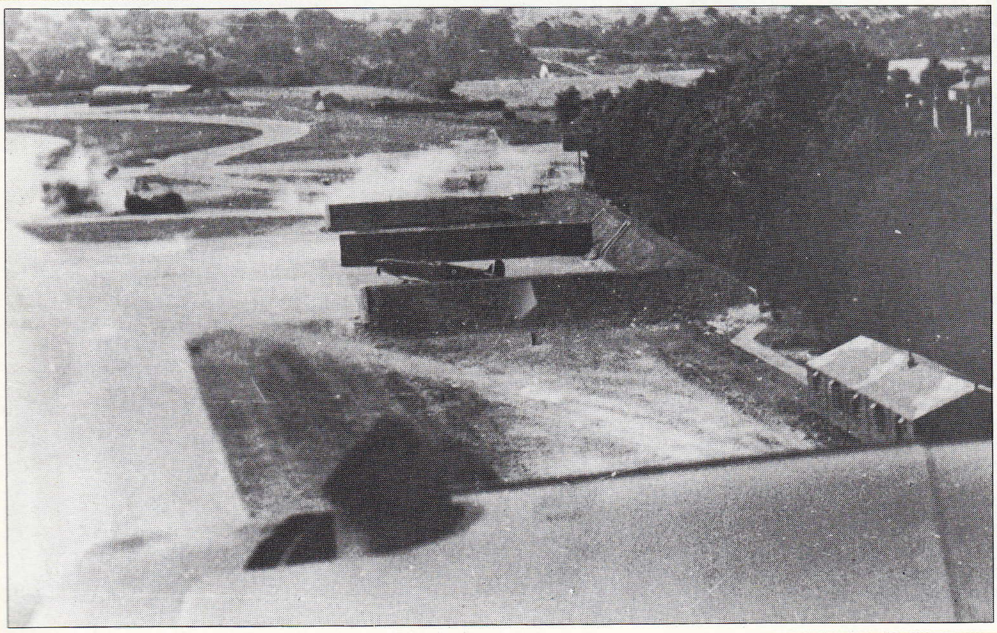
As daylight spread over southern England on Monday 26 August 1940, the constant drone of German reconnaissance Dornier Do 17s and Junkers Ju 88s warned RAF Fighter Command controllers of preparations for the day's raids as the Luftwaffe sought to discover the whereabouts of Air Chief Marshal Sir Hugh Dowding's fighter squadrons. Surprised by the strength of fighter reaction away from the south east on the previous day, when raids had been mounted over Hampshire and Dorset, the reconnaissance pilots duly noted the presence of Hawker Hurricane and Supermarine Spitfire squadrons at Kenley and Biggin Hill. Accordingly Generalfeldmarschälle Albert Kesselring and Hugo Sperrle decided on a series of attacks over a wide front during this Monday in the hope of confusing the defences; free-chasing *Staffeln* of Bf 109s were ordered to cover Kent and Sussex in the hope of jumping RAF squadrons as they were ordered from sector to sector to meet the widespread raids. Such was the continuing pattern of attacks aimed at the destruction of RAF Fighter Command.

Spitfire Mk Is of No. 92 Sqn accelerate into the sun to take off for the last sweep of the day. By this time, and at this stage in the battle, even the most experienced pilots were at the edge of utter exhaustion. Many of the other pilots were woefully inexperienced.

Having been watched on CH radar at Dover for some 30 minutes as it built up over Belgium and the Pas de Calais, the day's first major raid by about 40 Heinkel He 111s and a dozen Do 17s, escorted by 80 Bf 109s and some Bf 110s, crossed the Kent coast near Deal at about 11.30. As some of the Bf 109s broke away to engage in free-chasing around Manston, Lympne and Hawkinge (where they found no RAF fighters), and the main force continued westwards, Air Vice Marshal Keith Park ordered 40 Hurricanes and 30 Spitfires into the air from Kenley and Biggin Hill. The majority of these went into action as the bombers passed over Canterbury, and continued to press their attacks all the way back to Maidstone, though they did not manage to penetrate the fighter escort. The purpose of this raid (to split the defences) soon became apparent as the Heinkels turned south to attack Dungeness and Dorniers pushed on to Biggin Hill. No. 616 Squadron's Spitfires, ordered off from Kenley, were directed against the Heinkels but arrived too late; on turning north again they ran straight into a 'Balbo' (mass formation) of about 80 Bf 109s and lost seven aircraft within 30 seconds. Elsewhere the Defiants of No. 264 Squadron had been ordered off from Hornchurch and started their complicated cross-over attack manoeuvre against the Dorniers over Herne Bay; after claiming the destruction of three bombers they were in turn set on by about 50 Bf 109s which shot down three of the turret fighters. Seeing the escort busy with the Defiants, the pilots of No. 1 (Canadian) Squadron charged into the Dorniers, only to lose three Hurricanes (including that of their commanding officer, Squadron Leader E. A. McNab) in the bomber's savage cross-fire. However, two further Hurricane squadrons then entered the fray and, now forsaken by their escort, the Dorniers turned back before reaching Biggin Hill. Diving to gain speed, the bombers jettisoned their bombs on any town or village they crossed as they raced back to the coast.

Determined to catch the RAF fighters on their way home to refuel and rearm, Kesselring sent about 60 Bf 109s on free chases over Kent. But by 13.00 the skies had all but cleared and the German pilots returned empty handed. Many of the Hurricane pilots had landed at forward bases and were not spotted.

The tables had in effect been turned. Kesselring was already assembling his next bombing raid, comprising some 40 Do 17s of KG 1 and KG 2, for an attack on Debden and Hornchurch, north of the Thames. But whereas the RAF fighters were already prepared, the Bf 109s of two whole *Geschwader* had still to be refuelled. Soon after 14.00 Dunkirk CH warned of a raid flying north west of Margate, and some minutes later this was detected by Canewdon CH in Essex. The raid, comprising about 80 Do 17s, accompanied by 80 Bf 110s and 40 Bf 109s, split before crossing the Essex coast, half the force striking due west towards the Spitfire base at Hornchurch. Against the latter Park ordered off two squadrons of Hurricanes from North Weald and Kenley, as well as the Spitfires from Hornchurch itself, and these proved capable of turning the raid away, the Bf 109s already running short of fuel; indeed the German formation was quickly broken up by the British fighters, five bombers and four fighters being destroyed for the loss of five Hurricanes.



A photo (presumably taken during a raid on West Malling) demonstrates the remarkably low level at which some fields were attacked. Just beyond the blast pen containing a Spitfire (of No. 66 Squadron, perhaps) can be seen the dust of a smallish bomb bursting.

Hurricanes in the pre-war line astern formation break to attack the enemy. Not until after the battle would the RAF perfect the use of wingmen and 'finger four', which gave the Luftwaffe in their Schwarme *and* Rotte *a distinct advantage in fighter-versus-fighter combat.*

The Debden raid, comprising 40 Do 17s and 40 Bf 110s, crossed the coast just south of Colchester, but intense AA fire, as well as the appearance of the Hurricanes of No. 111 Squadron ordered down from Martlesham, forced this formation to split, leaving fewer than a dozen bombers to push on towards Debden. Despite the warnings passed to No. 12 Group, the fighters at Duxford were very slow off the ground, and the pilots of No. 310 (Czech) Squadron's Hurricanes made their way individually towards Debden despite difficulties with wrongly-fitted radio crystals. In the event the bombs dropped by the persistent Dorniers caused some damage to station buildings at Debden, but at that time all the resident fighter squadrons had been ordered to their forward bases, and only a single aircraft was damaged.

Worst hit of the Essex raiders was the formation of II and III/KG 2 which had split from the Debden raid, losing six or seven Do 17s and three Bf 110s when it ran into seven squadrons of Hurricanes and Spitfires as it passed to the east of Chelmsford, the pilots of No. 310 Squadron claiming three aircraft destroyed.

Third and last major raid of the day was sent by Sperrle and involved a force of about 50 He 111s, escorted by more than 100 Bf 109s and Bf 110s, sent to attack Portsmouth and Southampton soon after 16.00. It was thought likely that, with most of the fighter squadrons sent north to meet the earlier attacks, this raid would seriously damage the important ports without undue interference. In the event the Tangmere squadrons had not been involved in the day's earlier fighting, and Park was still able to meet the Portsmouth raid with 32 fighters, although more than 60 aircraft were ordered off. The Hurricanes and Spitfires succeeded in destroying four He 111s and four Bf 109s for the loss of four fighters.

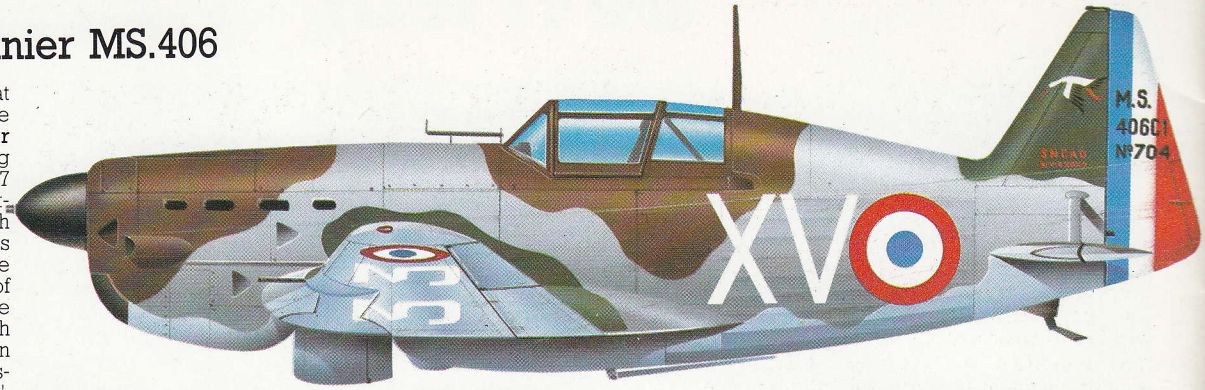
Total British losses for this day amounted to 15 Hurricanes, nine Spitfires and three Defiants destroyed, with five pilots and two Defiant gunners killed. Among those shot down were the commanding officers of Nos 1 (Canadian) and 310 (Czech) Squadrons and three flight commanders; fortunately none was seriously hurt. The Germans on the other hand lost 11 Do 17s, three Ju 88s, four He 111s, an He 59 rescue seaplane, four Bf 110s and 14 Bf 109s destroyed. Among the German casualties was the *Gruppenkommandeur* of I/KG 1, as well as three *Staffelkapitäne*.

The Luftwaffe raids achieved little material damage on the ground during the day as neither of Sperrle's afternoon raids succeeded in reaching their targets. The RAF's loss of more than 30 fighters was infinitely more serious: losses at this rate (the effective equivalent of two whole squadrons in a single day) if continued would bring Fighter Command to its knees in a forecastable period of time. Yet continue it did for more than 10 weeks until, through sheer bad generalship, the Germans abandoned the task of trying to destroy the RAF, and switched its attacks against the British civilian population. And Fighter Command survived.

Throughout the battle, the main German bomber was the Heinkel He 111, its broad, spade-like wings becoming familiar over London. This Staffel, *in its tight* Kette *(vics of three), is on its way to the capital. Before long, the attack was to switch to the hours of darkness.*

FRANCE

Morane-Saulnier MS.406



By May 1940, the MS.406 was outdated and hopelessly outclassed by the Germans. Nevertheless, it equipped some 14 Groupes de Chasse, including the famous Cigognes of 1ère GC1/2 at Nimes.

Most numerous of French fighters at the time of Germany's attack in the West in 1940, the **Morane-Saulnier MS.406** was a curious anomaly, having been ordered into production in 1937 when its performance was already notably far below that of current British and German fighters. Moreover, its complicated development within the MS.405-411 family was as wasteful of effort as it was counterproductive. The prototype MS.406 was in fact the fourth development **MS.405** and first flew on 20 May 1938 with 642-kW (860-hp) Hispano-Suiza 12Y31 and 'moteur-canon', typifying the continental practice of using a hub-firing cannon to avoid the need to synchronize its fire. By April 1938 orders totalling 955 MS.406s had been placed for completion by September 1939, but in the event only 572 had been produced by that date. At the outbreak of war these aircraft equipped five *groupes de chasse* at Chartres and Dijon, plus two in Algeria; 29 aircraft had been shipped to Tunisia and 10 to Indo-China. By 10 May 1940 the number of combat-ready MS.406s had actually dropped from 367 to 278, a situation quickly aggravated by the loss of 37 aircraft on the ground at Cambrai, Damblain, Vitry and Le Quesnoy on the first day. The MS.406 quickly proved to be outclassed in the air and during the Battle of France about 150 were lost in combat (plus some 100 on the ground). The aircraft's inferiority was acknowledged and by the time of the Armistice conversion to other aircraft was already being undertaken by 10 MS.406 *groupes*.

Specification

Morane-Saulnier MS.406

Type: single-seat fighter

Powerplant: one 642-kW (860-hp) Hispano-Suiza HS 12Y 31 V-12 piston engine

Performance: maximum speed 490 km/h (304 mph) at 4500 m (14,765 ft); climb to 6000 m (19,685 ft) in 9.0 minutes; service ceiling 10000 m (32,810 ft); range 1100 km (684 miles)

Weights: empty 1895 kg (4,178 lb); normal take-off 2540 kg (5,600 lb)

Dimensions: span 10.62 m (34 ft 10.1 in); length 8.17 m (26 ft 9.7 in); height 3.25 m (10 ft 8 in); wing area 16.00 m² (172.2 sq ft)

Armament: one 20-mm HS404 hub-firing cannon and two 7.5-mm (0.295-in) MAC 1934 machine-guns in the wings

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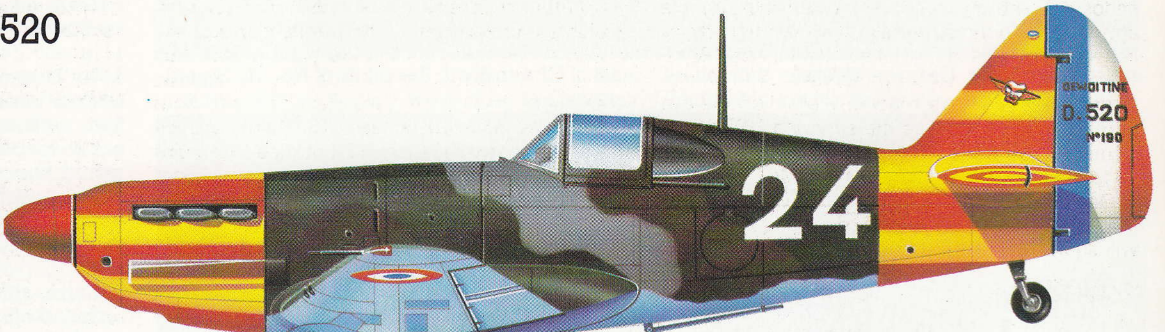
FRANCE

Dewoitine D.520



A Dewoitine D.520, based at Rayak in central Lebanon in June 1941. The prominent striping is to identify the aircraft as Vichy French, and so ostensibly neutral.

Best of all French fighters at the time of the great German attack in the West of May 1940 was the **Dewoitine D.520**, although it was probably no better than the RAF's Hurricane Mk I; moreover, no more than 36 had been delivered to a single *groupe de chasse* when the blow fell. Although the need for a fighter to replace the D.510 had been acknowledged as long ago as 1934, the D.520's design was not started until November 1936; the prototype was flown by Marcel Doret on 2 October 1938. Such delays were symptoms of the lethargy and procrastination that pervaded the French aircraft industry immediately before the war. Indeed it was not until 2 November 1939 that the first production D.520 was flown. First to receive the new fighter was GC I/3, and this *Groupe* first met the Luftwaffe on 13 May, shooting down three Hs 126s and an He 111 without loss. Some 43 other aircraft were quickly delivered to GC II/3, GC II/7, GC III/3 and GC III/6, and as new aircraft were completed Aéronavale Escadrilles AC 1, 2, 3, and 4 were equipped with a further 52 before the armistice was signed. Production of the D.520 continued in the Vichy (unoccupied) zone, and in due course a total of 235 D.520s served with Vichy forces in France and 202 in Africa. Highest-scoring French fighter pilot was Adjutant Pierre Le Gloan, a pilot of GC III/6 who destroyed 18 enemy aircraft (out of his eventual total of 22) while flying D.520s. Total production of the aircraft was 775.

Specification

Dewoitine D.520S (first 558 aircraft)

Type: single-seat fighter

Powerplant: one 694-kW (930-hp) Hispano-Suiza 12Y45 V-12 piston engine

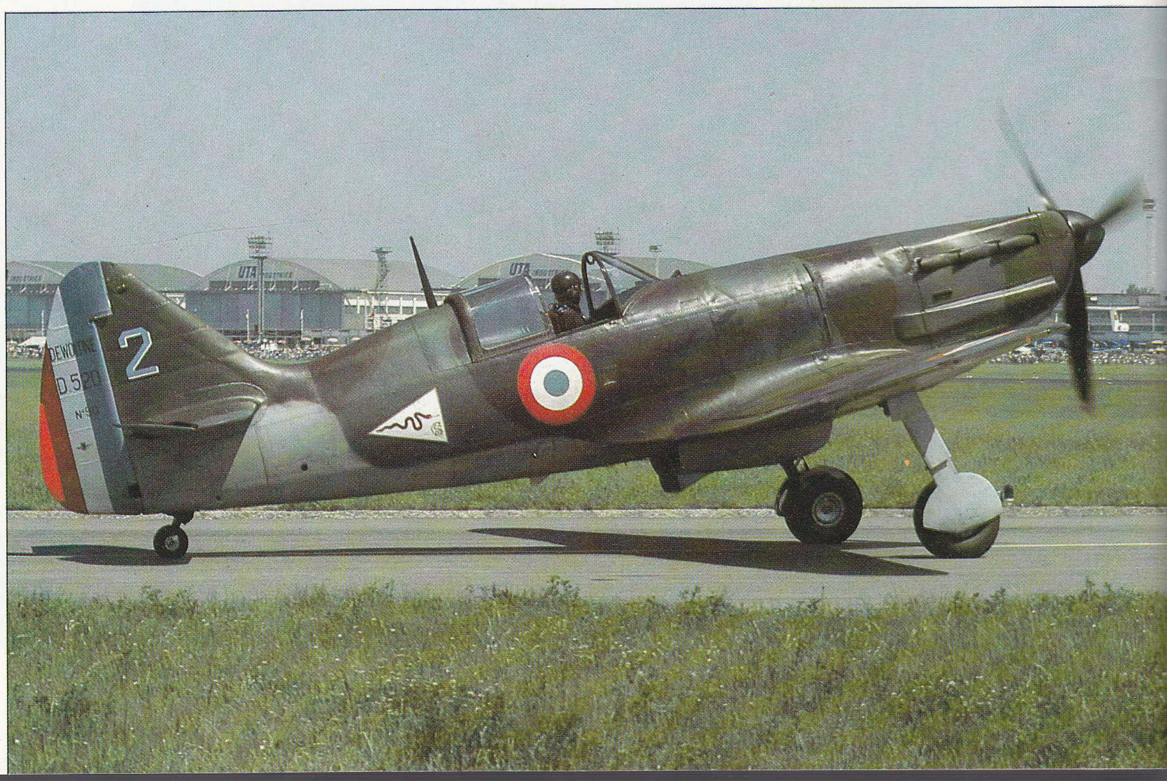
Performance: maximum speed 535 km/h (332 mph) at 5500 m (18,045 ft); climb to 4000 m (13,125 ft) in 5.82 minutes; service ceiling 10250 m (33,630 ft); normal range 890 km (553 miles)

Weights: empty 2125 kg (4,685 lb); normal take-off 2675 kg (5,897 lb)

Dimensions: span 10.20 m (33 ft 5.5 in); length 8.76 m (28 ft 8.75 in); height 2.57 m (8 ft 5.2 in); wing area 15.95 m² (171.7 sq ft)

Armament: one 20-mm HS404 hub-firing cannon and four 7.5-mm (0.295-in) MAC 1934 machine-guns in the wings

Below: A restored D.520 shows the fine lines of the French fighter of 1940. With a performance similar to the Hurricane, it was still outclassed by the Bf 109 but, in capable hands, undoubtedly gave a good account of itself in battle.



Italian Air Force

Italy's geographical position in Europe, adjacent to the Communist bloc and projecting into the eastern Mediterranean, underlines the country's importance in NATO as guardian of the alliance's southern flank. However, the Italian armed forces are afflicted with that international problem, inflation, which has meant reduced funding and a more rational approach to future spending. The Italian air force, or Aeronautica Militare Italiana (AMI), has some 310 combat aircraft, most assigned to the 5th Allied Tactical Air Force, along with Greek, Turkish and American units. Basic AMI unit composition comprises the *gruppo* of 12 aircraft, which equates roughly to an RAF squadron, up to three *gruppi* forming a *stormo*, or regiment. Manpower strength is some 70,600.

Most prolific combat type in AMI service is the Italian-developed Aeritalia F-104S Starfighter, a total of 205 being delivered and almost 170 currently equipping nine units. These replaced most of the Lockheed F-104Gs and are being supplemented by 100 Panavia Tornados. Four *gruppi* will receive Tornados, some being assigned the anti-shipping role armed with Kormoran missiles, while others fly reconnaissance and strike duties. Later in the 1980s, the AMI will receive four prototypes and 187 production Aeritalia/Aermacchi AMX lightweight fighter aircraft to replace the surviving F/RF-104G, Aeritalia G91R and Aeritalia G91Y fleets. The prototype AMX made its first flight in May 1984, but crashed shortly afterwards because of engine failure. The AMX is a joint Italian/Brazilian project and will equip both air forces.

A further extension of the Italian air force's re-equipment programme is the introduction into service of the Aermacchi M.B.339 basic trainer. Currently 81 M.B.339s are on order for the training units, and 15 form the equipment of the famous Frecce Tricolori aerobatic team. The three transport units have between them 12 Lockheed Hercules and nearly all the 44 Aeritalia G222s on order. Part of the AMI, but closely involved with the Italian navy, are the maritime reconnaissance units flying 18 Dassault-Breguet Atlantics.

The Aeritalia F-104S offers a great increase in capability over the earlier Starfighter models it has replaced. The F-104S may be armed with the extremely capable Italian-designed Selenia Aspide air-to-air missile.

The Aermacchi M.B.326K is now being replaced by the much-improved M.B.339 in the training role, though substantial numbers remain in service. Some are used for communications duties and a small number have been converted to target drone configuration.

Above: The Fiat (Aeritalia) G91 was designed to meet a NATO requirement for a lightweight tactical strike fighter. Small numbers of the original single-engined variants were exported, but only Italy operates the twin-engined G91Y.

Left: Four variants of the Piaggio PD-808 were produced for the Italian air force. The PD-808 ECM seen here is used for electronic countermeasures duties.

In addition there are some communications units attached to various *stormi* flying a variety of helicopters (Agusta-Bell AB.47s and AB.204s) and fixed-wing aircraft (Aermacchi M.B.326s and SIAI-Marchetti S.208Ms).

Naval aviation

The Marinavia is the Italian navy's aviation force, and is principally helicopter-equipped for operations from ships as well as shore bases. As with other Western navies, the Sikorsky Sea King forms the heavy ASW element, at least 20 equipping 1° Gruppo at La Spezia and 3° Gruppo at Catania. When the navy receives the carrier *Guiseppe Garibaldi* in 1985, 16 Sea Kings will be deployed in her. Short-range anti-submarine duties are flown by the 4° and 5° Gruppi, shore-based at Taranto with a planned total of 54 Agusta-Bell AB.212ASWs. Also at Taranto is a small training unit, 2° Gruppo, equipped with AB.47 and AB.204AS helicopters.

The fixed-wing long-range maritime patrol force comprises two *stormi* (the 30° at Cagliari-Elmas and the 41° at Catania) with 18 Dassault-Breguet Atlantics. These aircraft are on the AMI establishment but come under the command of the navy.

Army aviation

The Italian army has more than 300 helicopters and 100 fixed-wing aircraft. The Aviazione Leggera dell'Esercito (ALE) uses 24 heavy-lift Boeing Vertol CH-47C Chinooks built under licence in Italy, while some 200 AB.205s and AB.206s fly in the AOP and liaison roles. A batch of 18 AB.212s has recently been delivered for similar duties. For anti-tank duties, ALE evaluated the Agusta A 109 Hirundo during the 1970s, but only five machines were received, and these remain in use on an experimental basis, two being armed with TOW anti-tank missiles. More specifically designed for the attack role is the two-seat Agusta A 129 Mangusta armoured helicopter and a small evaluation batch has been purchased, with a possible order for up to 100 to follow. Main fixed-wing design is the SIAI-Marchetti SM.1019, a refined turboprop development of the older Cessna O-1 Bird Dog. Nearly 80 SM.1019s operated in 10 squadrons assigned to the AOP role.

Order of battle

First-line units

Panavia Tornado

Unit	*Base*
6° Stormo:	
154° Gruppo	Ghedi
36° Stormo:	
156° Gruppo	Gioia del Colle

Aeritalia F-104S Starfighter

Unit	*Base*
4° Stormo:	
9° Gruppo	Grosseto
5° Stormo:	
23° and 102° Gruppi	Rimini-Miramare
9° Stormo:	
10° Gruppo	Grazzanise
36° Stormo:	
12° and 156° Gruppi	Gioia del Colle
51° Stormo:	
22° and 155° Gruppi	Istrana/Treviso
53° Stormo:	
21° Gruppo	Cameri

Lockheed F-104G Starfighter

Unit	*Base*
3° Stormo:	
28° and 132° Gruppi	Verona Villafranca
20° Gruppo	Grosseto

Fiat (Aeritalia) G91R

Unit	*Base*
2° Stormo:	
14° and 103° Gruppi	Treviso-San Engelo

Fiat (Aeritalia) G91Y

Unit	*Base*
8° Stormo:	
101° Gruppo	Cervia-San Giorgio
32° Stormo:	
13° Gruppo	Brindisi

Dassault-Breguet Atlantic

Unit	*Base*
30° Stormo:	
86° Gruppo	Cagliari Elmas
41° Stormo:	
88° Gruppo	Catania

Training and electronic warfare units

Aeritalia G222RM

Unit	*Base*
14° Stormo:	
71° Gruppo	Pratica di Mare

Aermacchi M.B.339

Unit	*Base*
14° Stormo:	
8° Gruppo	Pratica di Mare
313° Gruppo	Rivolto
212°, 213° and 214° Gruppi	Lecce Galatina

Piaggio PD-808GE/RM

Unit	*Base*
14° Stormo:	
8° and 71° Gruppi	Pratica di Mare
306° Gruppo	Ciampino

Transport and SAR units

Aeritalia G222

Unit	*Base*
2° and 98° Gruppi	Pisa

Lockheed C-130H

Unit	*Base*
50° Gruppo	Grazzanise

McDonnell Douglas DC-9

Unit	*Base*
306° Gruppo	Ciampino

Agusta AS-61TS

Unit	*Base*
31° Stormo:	
93° Gruppo	Ciampino

Agusta HH-3F

Unit	*Base*
15° Stormo;	
82° to 85° Centro SAR	Ciampino